Environmental Guide To West Coast Port Site Selection

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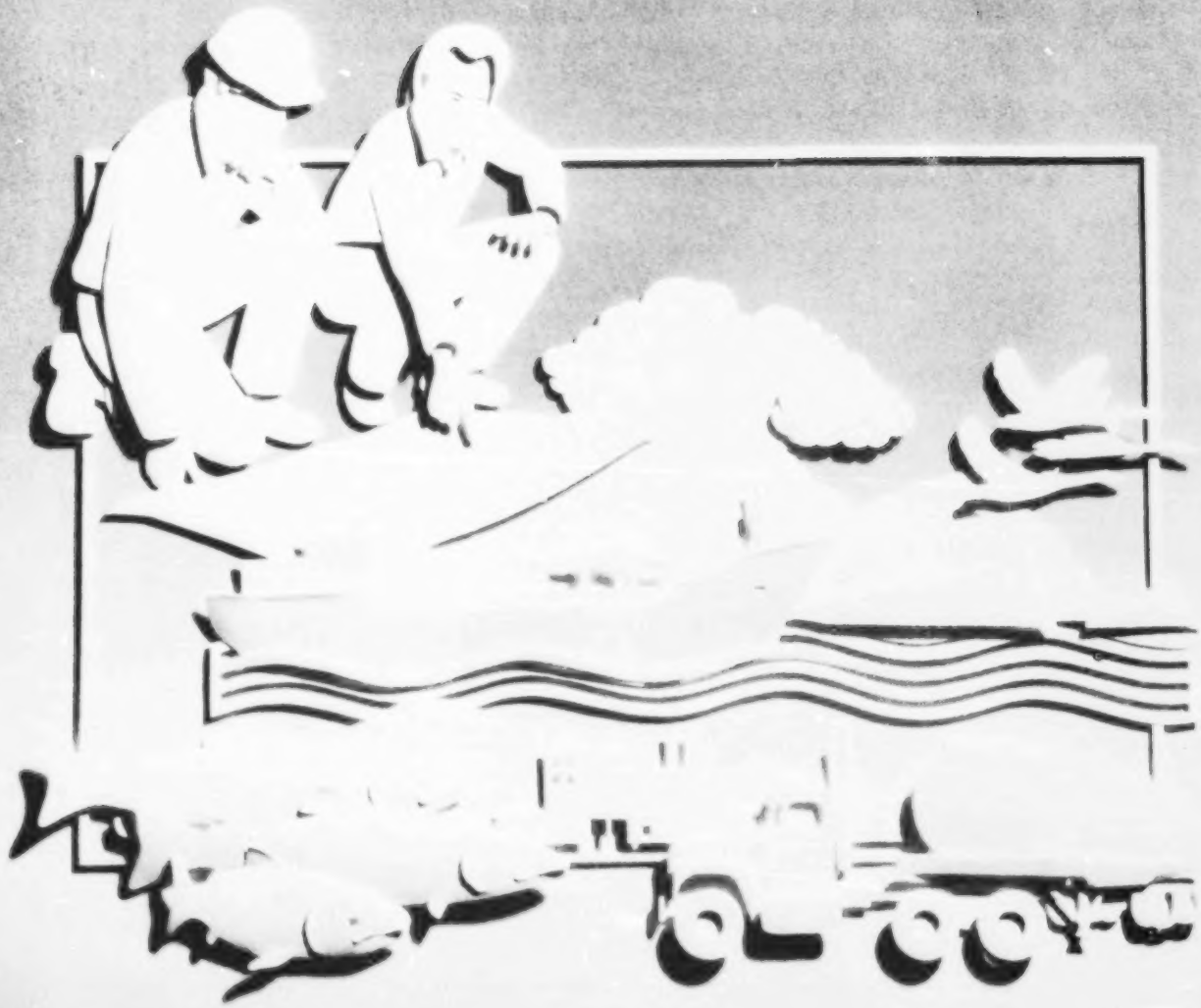

ENVIRONMENTAL GUIDE TO WEST COAST PORT SITE SELECTION

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PREFACE

This guide provides an overview summary of site characteristics for 18 representative port sites on the British Columbia coast in order to illustrate environmental siting criteria for new port industrial development. It does not alter the normal regulatory or permitting requirements or procedures for approval of specific developments or projects. Detailed site investigation would be required to determine the ultimate suitability of a site for a specific use. Nothing in this report should be construed as a proposal for port site development.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

This guide summarizes the major physical, biological, social, servicing and land status considerations that can influence the location of port and tidewater industrial site development on the British Columbia coast. It identifies and defines a range of environmental and technical criteria and illustrates their use in evaluating a representative selection of 18 sites.

Despite the length of the B.C. coast, there are relatively few locations which are ideally suited for industrial development. In the past, some proponents of coastal port site developments have encountered difficulties in finding locations socially and environmentally acceptable as well as economically feasible. This guide is designed to assist proponents in site selection by highlighting critical criteria which must be considered when reviewing possible industrial locations.

There are three principal types of potential port sites in coastal British Columbia:

- sites located on or near estuaries with established or easily developed transportation links and low development costs, but with potentially high social and environmental impacts
- sites located further away from estuaries with lower potential environmental impacts, but with more difficult access and higher development costs
- compromise sites, with reasonable access, developable land and manageable environmental impacts.

Each of these types is represented in this guide by several examples. The ability of specific sites to accommodate new industrial use with acceptable environmental impacts will vary with both site characteristics and industrial development requirements. A number of evaluation criteria can be used to describe and evaluate these sites.

2. EVALUATION CRITERIA FOR PORT SITE SELECTION

Port site selection begins with the consideration of a variety of environmental and technical criteria based on physical, biological, social, land use, servicing and land status data. Such information can be derived from available reports, government records, marine charts, maps and air photos. The criteria presented here provide a preliminary indication of site suitability for industrial development. More detailed data and methods of analysis can be used for project siting and design at subsequent stages of planning. In addition, specific regulatory and permitting requirements have to be considered.

Other criteria, not considered here, include distance to markets, sources of raw materials, availability of labour, economics and product hazards. Various rating methods can be used to compare or rank alternative sites for certain industrial uses. This guide does not do this, but simply highlights some of the types of information needed to undertake an initial site selection process.

The environmental and technical criteria identified in this guide are defined below. Key sources are also listed.

Physical

1. **Developable Area:** the approximate size (hectares) of land area with less than 10% slope that can easily be developed. Sources: maps and site reports.

2. **Berth Potential:** the estimated number of deepwater berths (>11 metres deep). Sources: marine charts and probable development scenarios.

3. **Depth & Dredging Requirements:** the predominant minimum depth (metres) of nearshore waters adjacent to the site and the potential dredging requirements (significant, moderate, minor or none) at the dock site. Source: marine charts.

4. **Terrain:** the predominant surficial material occurring at the site including anthropogenic, colluvial, fluvial, organic, morainal, bedrock and marine. Sources: provincial terrain mapping and previous site studies.

5. **Watercourses:** major and minor watercourses on or adjacent to the site. Sources: maps and air photos.

6. **Natural Hazards:** a relative classification of potential site hazards, some of which may be manageable by mitigation. These include slope instability, earthquake damage risk and flooding potential. Sources: previous studies, local topography and hydrology.

Biological

7. **Estuarine Habitat:** the estimated area (hectares) of estuarine habitat at the site or immediately adjacent to the site and within a five kilometre radius. Included are intertidal marsh, intertidal mud and sand, shallow water (generally less than four metres in depth) and other habitat (e.g., riparian) associated with the marine and freshwater interface. Sources: available habitat maps of the Fraser, Squamish, Nanaimo, Hardy Bay and Kitimat River estuaries, and air photos and marine charts for other estuarine areas.

8. **Average Salmon Escapement:** the average annual total escapement for the five species of salmon at the site and for streams located within a five kilometre radius. Escapement is defined as the number of adult anadromous fish which return to their streams of origin for spawning. Stocks which utilize large estuarine areas (such as the Fraser and Skeena River stocks) are shown in italics in the sites in this guide. Source: Department of Fisheries and Oceans.

9. **Other Fish & Marine Life:** information on other aquatic life and marine mammals identified at the site. Sources: previous environmental surveys and mapping.

10. **Birds:** records of winter bird counts and habitat. Source: Canadian Wildlife Service.

Social

11. **Population:** population within approximately five kilometres of the site. Source: Statistics Canada.

12. **Land Use:** present use of the land. Sources: site reports and air photos.

13. **Foreshore Use:** present use of the foreshore. Sources: site reports, air photos and land status data.

14. **Fisheries:** commercial, recreational and Native food fisheries which occur on or near the site. Sources: previous environmental reports.

15. **Heritage Sites:** the number of recorded heritage sites. Source: B.C. Heritage Conservation Branch.

Services

16. **Road Access:** presence of or distance (kilometres) to a highway, local road or industrial road. Sources: maps and interviews.

17. **Rail Access:** presence of or distance to a railway. Sources: maps.

18. **Development Services:** presence of electricity, community water system and community sewer. Sources: previous site reports.

Land Status

19. **Ownership:** private and/or Crown owner of the site. Source: B.C. Surveyor General Branch and previous site reports.

20. **Crown Status:** any reserves, leases or encumbrances applying to the site. Source: B.C. Surveyor General Branch.

21. **Zoning:** land use designations or regulations affecting the site. Source: interviews and previous site reports.

3. POTENTIAL PORT SITES ON THE B.C. COAST

A wide range of sites on the British Columbia coast have been developed as industrial port sites or otherwise suggested for port development. Table 1 and Figure 1 provide a list of 66 such potential sites. The list is not exhaustive; there may be other sites not included in this survey. The port sites listed were selected on the basis of:

- sites presently designated for industrial use in conjunction with existing industrial parks
- sites previously proposed for industrial use by private or public developers
- sites suggested by government agencies as alternatives for development.

Some of the potential locations provide serviced or readily developable industrial land behind the port site. Other sites require extensive site study and preparation. With adequate design, mitigation and compensation, many environmental sensitivities can be avoided or appropriately managed.

Various federal, provincial and local government regulations, policies and guidelines provide the framework for determining the acceptability of project location and design. In areas of important fish habitat, for example, the Department of Fisheries and Oceans administers a policy and guidelines for "no net loss" of habitat. Other provincial policies and guidelines apply for the siting and design of energy projects.

While there are apparent environmental, social and economic advantages at some sites compared to others, the feasibility of industrial use of an undeveloped port site can only be determined through detailed site planning and discussions with appropriate government agencies.

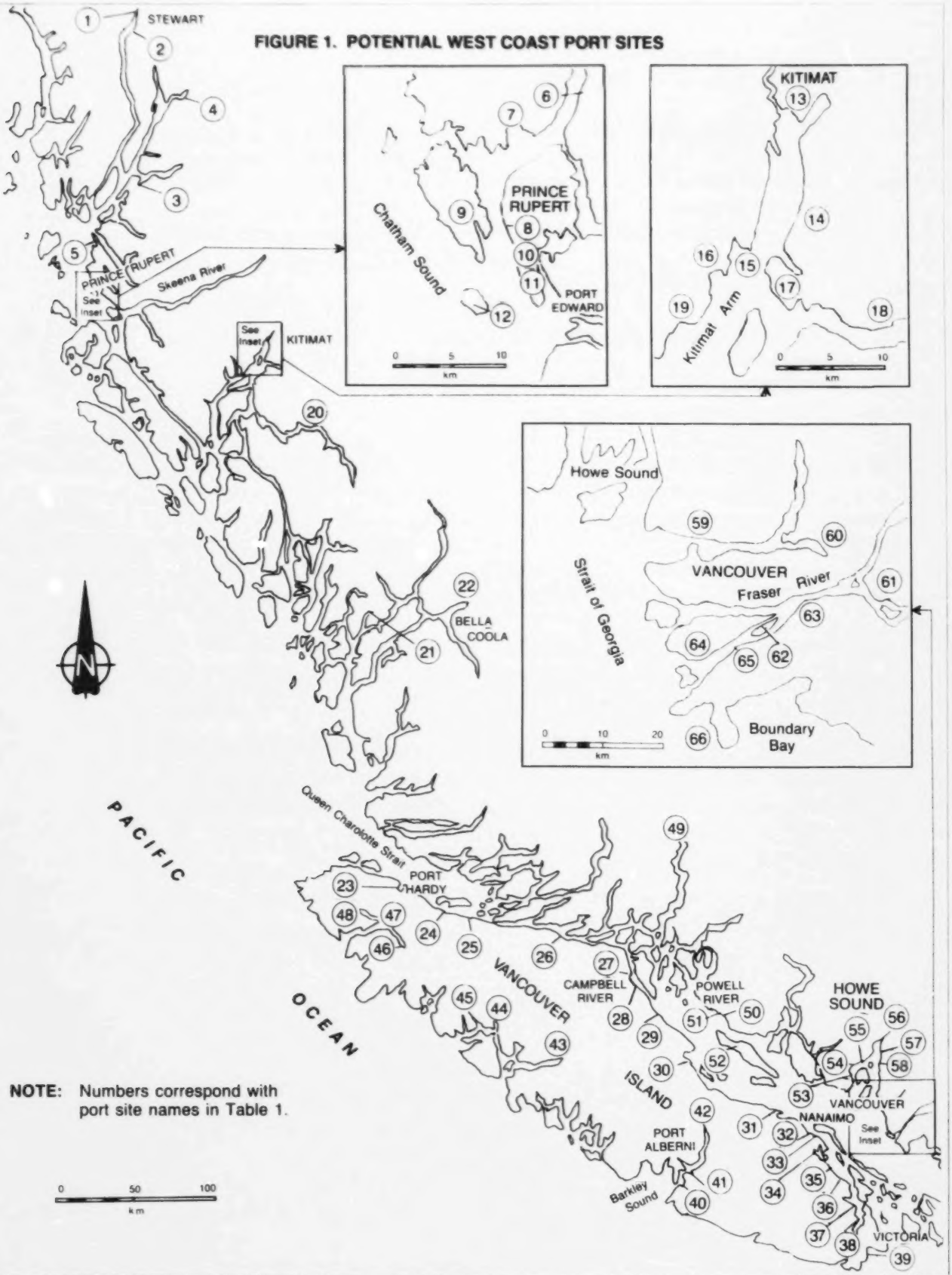
From the list of potential sites, a sample was selected to represent the range of available B.C. coastal sites.

TABLE 1. POTENTIAL WEST COAST PORT SITES

MAP KEY NUMBER	AREA	POTENTIAL PORT SITE
1	PORTLAND INLET	**STEWART**
2		**MARMOT BAY**
3		OBSERVATORY INLET
4		**ALICE ARM**
5	PRINCE RUPERT	**PORT SIMPSON**
6		OSBORN COVE
7		BACON COVE
8		CASEY POINT
9		DIGBY ISLAND
10		**SOUTH KAIEN ISLAND**
11		RIDLEY ISLAND
12		KINAHAN ISLAND
13	MID-COAST	KITIMAT
14		WATHLSTO
15		**BISH COVE**
16		EMSLEY COVE
17		CLIO-GOBEIL BAYS
18		KILDALA
19		MARKLAND POINT
20		KEMANO
21		**OCEAN FALLS**
22		BELLA COOLA
23	VANCOUVER ISLAND	**PORT HARDY**
24		PORT MCNEILL
25		BEAVER COVE
26		KELSEY BAY
27		MENZIES BAY
28		DUNCAN BAY
29		OYSTER BAY
30		UNION BAY
31		NORTHWEST BAY
32		**DUKE POINT**
33		HARMAC SOUTH
34		KULLEET BAY
35		CHEMAINUS
36		CROFTON
37		HATCH POINT
38		BAMBERTON
39		ESQUIMALT
40		TREVOR CHANNEL
41		**SARITA BAY**
42		PORT ALBERNI
43		GOLD RIVER
44		TAHSIS
45		ZEBALLOS
46		PORT ALICE
47		RUPERT
48		HOLBERG
49	HOWE SOUND - SOUTH COAST	BUTE INLET
50		POWELL RIVER
51		HARWOOD
52		TEXADA
53		**HILLSIDE**
54		MCNAB CREEK
55		POTLATCH CREEK
56		**SQUAMISH**
57		**BRITANNIA BEACH**
58		FURRY CREEK
59	LOWER MAINLAND	**NORTH VANCOUVER**
60		PORT MOODY
61		PITT MEADOWS
62		**ANNACIS ISLAND**
63		FRASER SURREY
64		FRASER RICHMOND
65		TILBURY ISLAND
66		**ROBERTS BANK**

NOTE: SAMPLE PORT SITES IN BOLD

FIGURE 1. POTENTIAL WEST COAST PORT SITES



NOTE: Numbers correspond with port site names in Table 1.

4. SAMPLE PORT SITE DESCRIPTIONS

For illustrative purposes in this guide, three sites from each of six main B.C. coastal regions were selected for presentation. This sample set includes accessible sites situated on or close to sensitive estuaries, remote sites located some distance from major transportation links, and sites considered compromises between these. The list is not comprehensive, but provides a general representation of sites to demonstrate the application of siting criteria. Inclusion of a site does not mean that the site is acceptable for any specific type of industrial development.

A summary of the major site characteristics of the 18 representative port sites is presented in Table 2. These data were derived from the port site information presented in the individual site maps and data sheets which follow Table 2.

The 18 sites in the sample vary in size from 4 to 830 hectares. The diversity of site characteristics is reflected in the table. Some sites, particularly those in close proximity to major estuaries, have higher environmental concerns than others. Information on estuarine habitat, fish escapements, birds and other criteria provide relative indicators of environmental importance. In certain cases, small sites are located adjacent to existing industrial lands within large estuaries. In other cases, large sites are located outside of estuarine areas. Some environmental attributes may only apply to portions of sites.

Table 2 also indicates whether a site is serviced industrial land, undeveloped industrial land or presently undesignated for industrial use, providing a reflection of local objectives or readiness for industrial use.

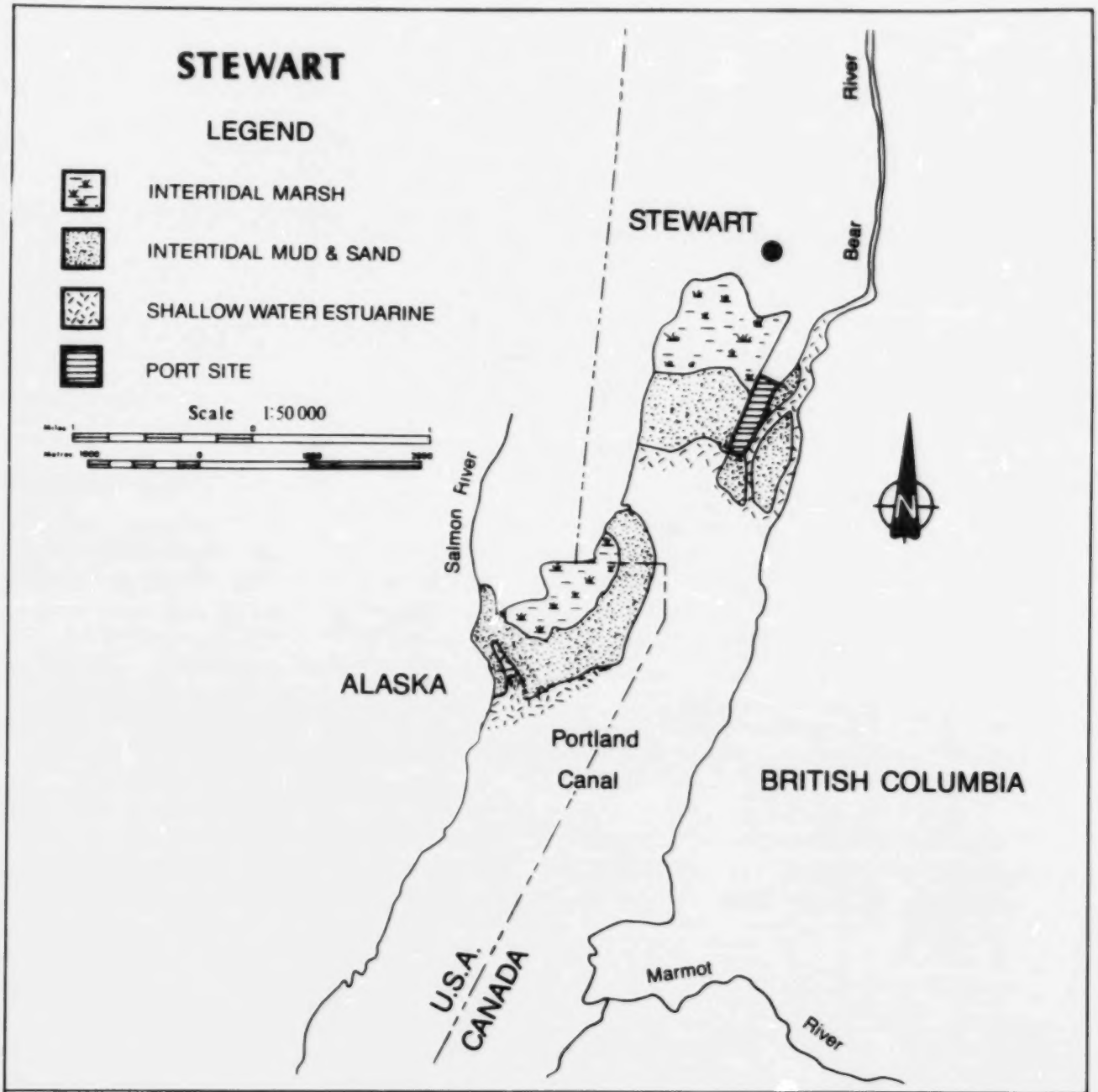
There is significant variation in location, access, services and environmental and social factors within this range of alternative sites. Site selection requires a careful analysis of the balance of costs and benefits at each site with particular emphasis on the possible environmental losses as well as evaluation of potential mitigative and compensation alternatives.

TABLE 2. SAMPLE PORT SITE CHARACTERISTICS

COASTAL AREA/ PORT SITE	SITE SIZE (hectares)	SITE ESTUARINE HABITAT (hectares)	AREA ESTUARINE HABITAT (hectares)	SITE FISH ESCAPEMENTS *	AREA FISH ESCAPEMENTS *	AREA BIRDS	NATURAL HAZARD POTENTIAL	AREA POPULATION	LAND ACCESS	OWNERSHIP LAND STATUS
PORTLAND INLET AREA										
Stewart	22	194	442	9272	10,000+	moderate	moderate	858	good	Crown
Marmot Bay	66	46	256	no data	no data	moderate	moderate	858	none	Crown/Private
Alice Arm	57	13	251	no data	17,607	moderate	moderate	6	none	Crown
PRINCE RUPERT AREA										
Port Simpson	830	24	49	3783	3783	moderate	low	150	none	Crown/Private
South Kaien Island	50	35	1151	0	*3,000,000*	low	moderate	704	good	Crown/Private
Ridley Island	375	358	2126	0	*3,000,000*	low	low	704	good	Crown Corp.
MID-COAST AREA										
Kitimat	30	28	1829	*78,302*	*78,302*	high	high	11,196	good	Private
Bish Cove	80	0	65	17,404	18,982	low	low	0	none	Indian Reserve
Ocean Falls	100	7	7	5605	5605	low	moderate	12	remote	Crown
VANCOUVER ISLAND AREA										
Port Hardy	90	2	248	0	41,619	high	moderate	5389	good	Crown/Private
Duke Point	70	0	900	0	32,859	low	low	49,029	good	Crown Corp.
Sarita Bay	215	8	88	0	38,120	moderate	low	0	remote	Crown/TFL
HOWE SOUND AREA										
Squamish	4	2	475	*93,881*	*93,881*	high	moderate	10,517	good	Private
Britannia Beach	80	1	11	0	0	low	high	210	good	Private
Hillside	53	11	17	100	200	low	moderate	20	good	Private
LOWER MAINLAND AREA										
North Vancouver	25	1	21	150	5492	low	low	68,241	good	Private
Annacis Island	110	14	85	*5,000,000*	*5,000,000*	moderate	moderate	12,000	good	Private
Roberts Bank	47	20	4497	*5,000,000*	*5,000,000*	high	moderate	0	good	Crown Corp.

* NOTES:

1. Average recorded escapements of salmon, 1953-85.
2. Fish escapements which utilize large estuarine areas near the site are shown in italics.



The Stewart site incorporates about 22 hectares of potential industrial land adjacent to the present port access road and barge terminal, with good access to the town and Highway 37A. It is being promoted for industrial development by the municipality. The site is largely intertidal mud and sand with some intertidal marsh. Most of the sensitive estuarine habitat is located west of the site. The site would require dredging and reclamation. The Stewart Port Master Plan describes the proposed development site as having low environmental sensitivity within the Bear River estuary. Overall, however, the estuary is an important environmental resource, supporting average salmon escapements of over 9000 fish annually. The nearby Salmon River estuary on the Alaskan side of the border is also a significant fish-producing system.

PORT SITE: STEWART

PHYSICAL

1.	Developable Area:	22 hectares
2.	Berth Potential:	1
3.	Depth & Dredging Requirements:	0 metres, significant dredging
4.	Terrain:	Marine, fluvial, anthropogenic
5.	Watercourses:	Bear River
6.	Natural Hazards:	Moderate flooding potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	72	112
	Intertidal Mud & Sand:	94	154
	Shallow Water Estuarine:	28	78
	Other, riparian:	0	98
	Total:	**194**	**442**
8.	Average Salmon Escapement:	9272	10,000+
9.	Other Fish & Marine Life:	Crab, shrimp, prawn	
10.	Birds:	Moderate populations	

SOCIAL

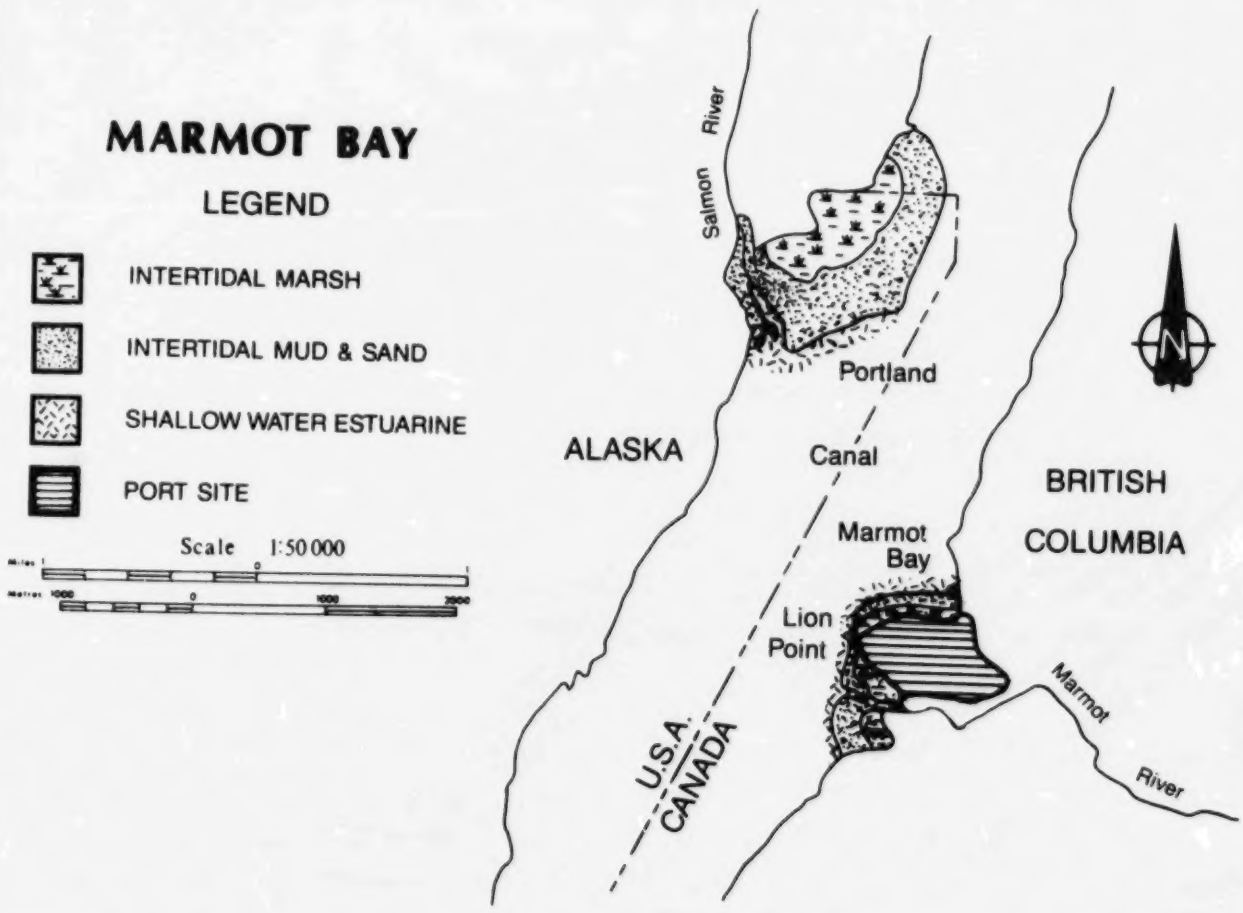
11.	Population (1986):	858 - Stewart
12.	Land Use:	Shipping facilities
13.	Foreshore Use:	Log storage, marina, wharves
14.	Fisheries:	Commercial & Native salmon, shrimp, prawn
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	Highway 37A
17.	Rail Access:	None
18.	Development Services:	Electricity

LAND STATUS:

19.	Ownership:	Crown
20.	Crown Status:	Reserved for industrial purposes
21.	Zoning:	Industrial



The 66 hectare site at Marmot Bay is located 6 km south of Stewart on a site designated for industrial use. The site is a relatively flat alluvial fan on the north side of the Marmot River, with probable low development costs. Flooding hazards are uncertain. The foreshore area is largely mud flats and shallow water with little productive marsh. The site does not front on the river and therefore direct environmental impacts are likely avoidable. The Stewart Port Master Plan proposes a berthing facility extending from Lion Point. A small portion of the site (Lot 467) is privately owned. No road access is presently available.

PORT SITE: MARMOT BAY

PHYSICAL

1.	Developable Area:	66 hectares
2.	Berth Potential:	1
3.	Depth & Dredging Requirements:	0 metres, minor dredging
4.	Terrain:	Colluvial, possibly morainal
5.	Watercourses:	Marmot River
6.	Natural Hazards:	Moderate flooding potential

BIOLOGICAL

7. Estuarine Habitat (hectares)

	Site	Area (within 5 km)
Intertidal Marsh:	12	52
Intertidal Mud & Sand:	24	84
Shallow Water Estuarine:	10	60
Other, riparian:	0	60
Total:	**46**	**256**

8.	Average Salmon Escapement:	No data	No data
9.	Other Fish & Marine Life:	Crab, shrimp, prawn	
10.	Birds:	Moderate populations	

SOCIAL

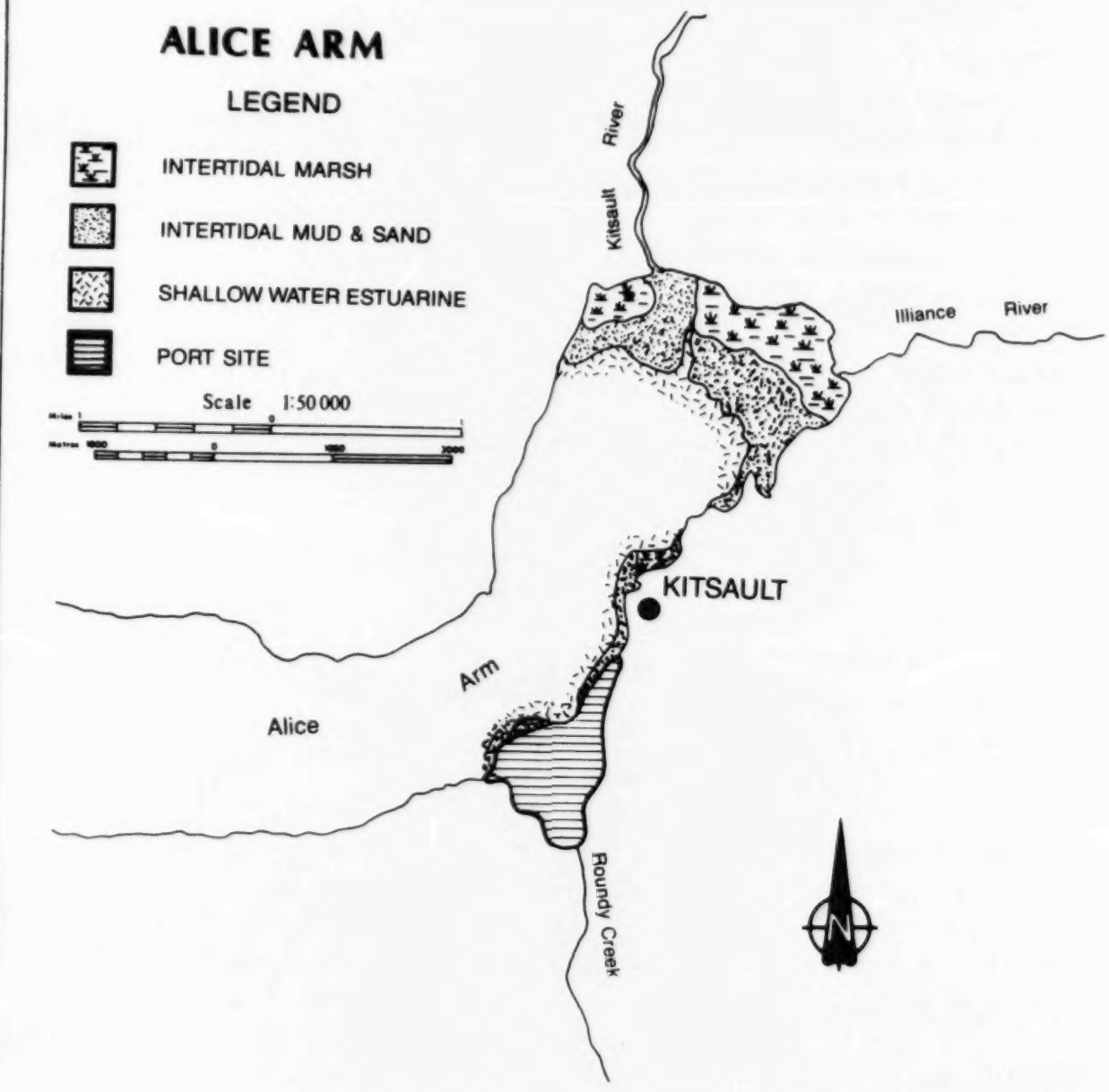
11.	Population (1986):	858 - Stewart
12.	Land Use:	Vacant
13.	Foreshore Use:	Vacant, log storage nearby
14.	Fisheries:	Commercial & Native salmon, shrimp, prawn
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	6 km industrial road required
17.	Rail Access:	None
18.	Development Services:	None

LAND STATUS:

19.	Ownership:	Crown, private (Lion Point)
20.	Crown Status:	Reserve & lease application for industrial purposes
21.	Zoning:	None



The Alice Arm site, incorporating about 57 hectares of flat land, is located in the lower reaches of Roundy Creek. The discharge from the creek and the shallow nearshore limit potential ship access to northern portions of the site. Although the nearby Kitsault-Illiance estuary has very high biological values, the Alice Arm site itself apparently has few major environmental or development constraints. Kitsault, a small, largely abandoned mining town, is located at the head of Alice Arm. No data are available on fish utilization of Roundy Creek.

PORT SITE: ALICE ARM

PHYSICAL

1.	Developable Area:	57 hectares
2.	Berth Potential:	1
3.	Depth & Dredging Requirements:	1 metre, minor dredging
4.	Terrain:	Colluvial, fluvial
5.	Watercourses:	Roundy Creek
6.	Natural Hazards:	Moderate flooding potential

BIOLOGICAL

7. Estuarine Habitat (hectares)	Site	Area (within 5 km)
Intertidal Marsh:	3	113
Intertidal Mud & Sand:	9	129
Shallow Water Estuarine:	1	9
Other, riparian:	No data	No data
Total:	**13**	**251**

8.	Average Salmon Escapement:	No data	17,607
9.	Other Fish & Marine Life:	Crab	
10.	Birds:	Moderate populations	

SOCIAL

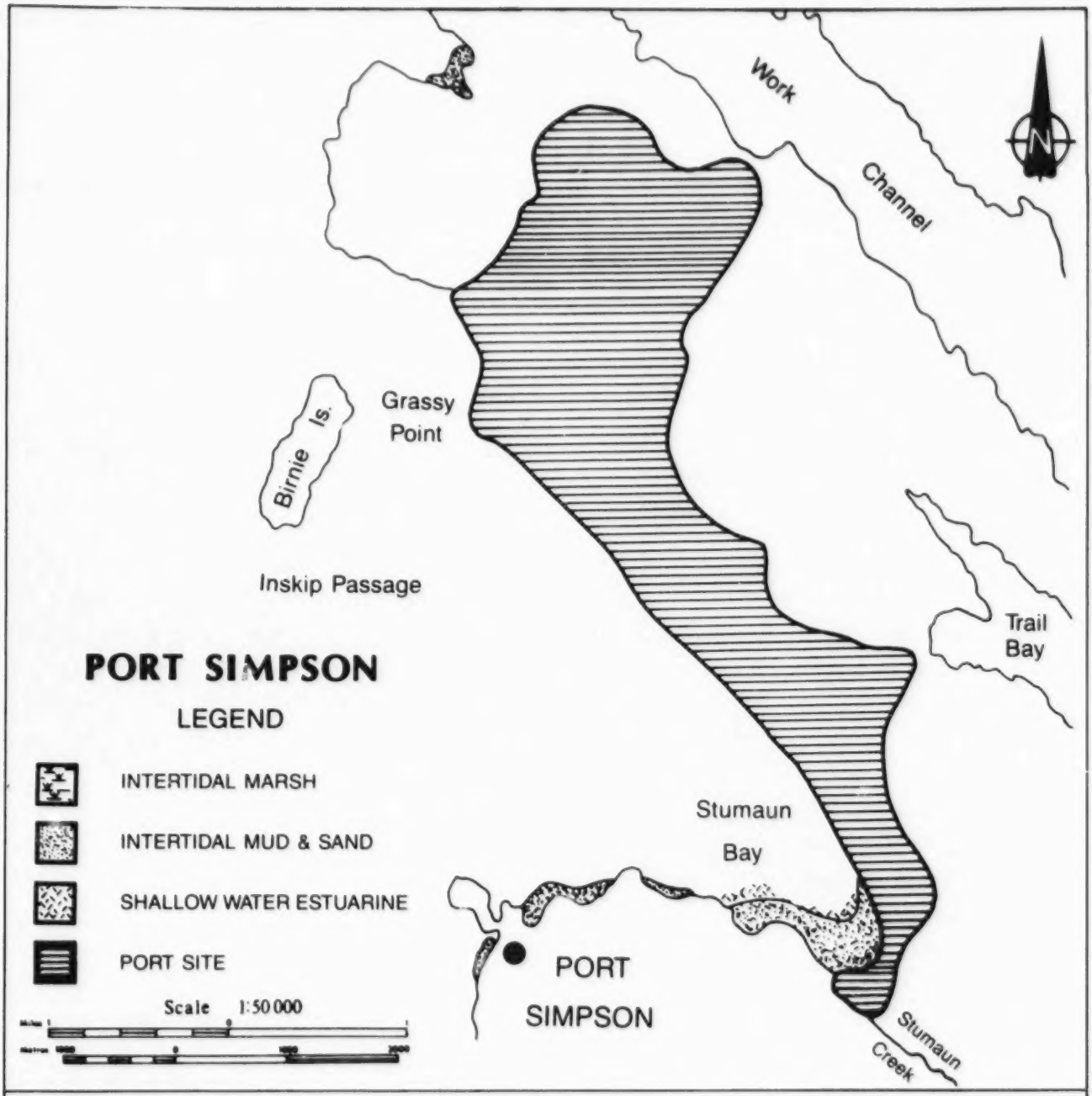
11.	Population (1986):	6
12.	Land Use:	Vacant
13.	Foreshore Use:	Vacant
14.	Fisheries:	Commercial & Native salmon
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	3 km industrial road required
17.	Rail Access:	None
18.	Development Services:	None

LAND STATUS:

19.	Ownership:	Crown
20.	Crown Status:	Hecate Provincial Forest, reserve for Public Works Canada for industrial purposes, reserve for flooding, application for licence for industrial purposes
21.	Zoning:	Official Community Plan for Kitsault available



The site east of Port Simpson village involves about 830 hectares of gently sloping land which is primarily Crown-owned. It has previously been considered as a potential LNG terminal site and has been extensively studied. Most of the site has good deep water access. The privately owned Grassy Point section of the site is inaccessible and would require 8 km of new road for access to Port Simpson or 25 km of new road for access to Prince Rupert. A significant salmon fishery exists on Stumaun Creek at the south end of the site and a major herring spawning area also is present, although impacts are likely avoidable. The major concerns include the potential social impacts on the Native community and the development of access roads.

PORT SITE: PORT SIMPSON

PHYSICAL

1.	Developable Area:	830 hectares
2.	Berth Potential:	5+
3.	Depth & Dredging Requirements:	3 metres, minor dredging
4.	Terrain:	Bedrock, organic
5.	Watercourses:	Stumaun Creek
6.	Natural Hazards:	Low potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	2	3
	Intertidal Mud & Sand:	20	35
	Shallow Water Estuarine:	2	11
	Other, riparian:	No data	No data
	Total:	**24**	**49**
8.	Average Salmon Escapement:	3783	3783
9.	Other Fish & Marine Life:	Herring spawning	
10.	Birds:	Moderate populations - seabirds, bald eagles, waterfowl	

SOCIAL

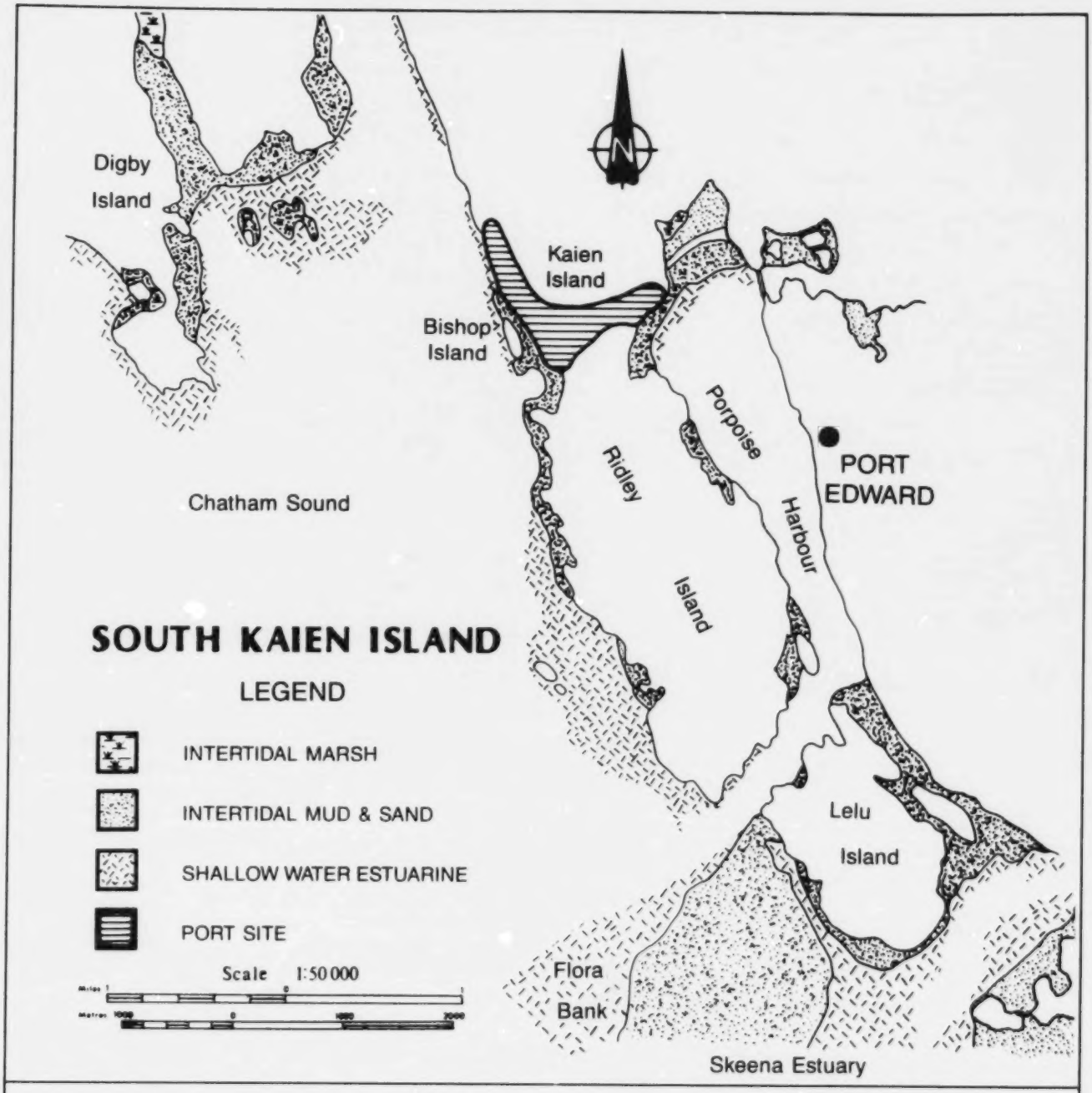
11.	Population (1986):	150 - Port Simpson
12.	Land Use:	Vacant
13.	Foreshore Use:	Vacant
14.	Fisheries:	Commercial & Native salmon, shellfish
15.	Heritage Sites:	3

SERVICES

16.	Road Access:	8 km industrial road required
17.	Rail Access:	None
18.	Development Services:	None

LAND STATUS:

19.	Ownership:	Crown, private
20.	Crown Status:	Hecate Provincial Forest, 65 ha reserve for industrial purposes by B.C. Enterprise Corporation, private lands at Grassy Point
21.	Zoning:	None



Near Prince Rupert, the southern tip of Kaien Island has about 50 hectares of developable land across from the Ridley Island grain terminal. A road and railway intersect the site. Development constraints are largely associated with the steep slopes of Kaien Island and foreshore reclamation requirements for marine access. The area around Porpoise Harbour and Bishop Island is privately owned. No major environmental concerns exist at the site. The wide and dispersed estuarine area of the Skeena River extends to the south of Ridley Island with much diminished influence near South Kaien Island.

PORT SITE: SOUTH KAIEN ISLAND

PHYSICAL

1.	Developable Area:	50 hectares
2.	Berth Potential:	2
3.	Depth & Dredging Requirements:	2 metres, significant dredging
4.	Terrain:	Morainal
5.	Watercourses:	None
6.	Natural Hazards:	Moderate slope instability potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	3	33
	Intertidal Mud & Sand:	12	178
	Shallow Water Estuarine:	20	940
	Other, riparian:	No data	No data
	Total:	**35**	**1151**
8.	Average Salmon Escapement:	0	*3,000,000*
9.	Other Fish & Marine Life:	Crab, clams, herring spawning, harbour seals	
10.	Birds:	Low population - bird count of 600, 35 species	

SOCIAL

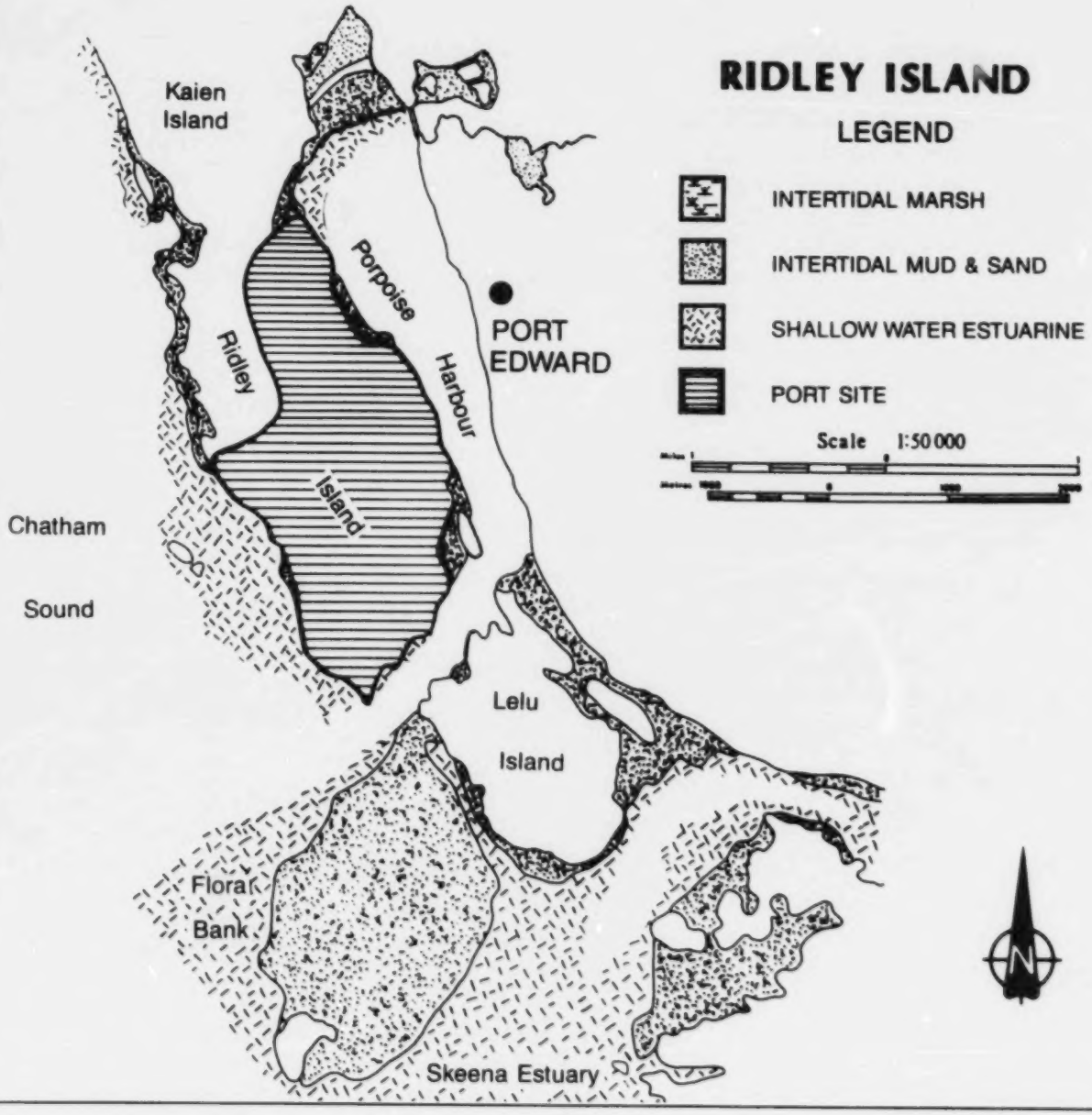
11.	Population (1986):	704 - Port Edward
12.	Land Use:	Road and rail right-of-way
13.	Foreshore Use:	Access road
14.	Fisheries:	Commercial & recreational salmon, groundfish
15.	Heritage Sites:	1

SERVICES

16.	Road Access:	Industrial road
17.	Rail Access:	CN Rail
18.	Development Services:	Electricity, community water

LAND STATUS:

19.	Ownership:	Crown, Crown Corporation, private
20.	Crown Status:	Right-of-way for industrial purposes for Prince Rupert Port Corporation
21.	Zoning:	Industrial



This site includes approximately 375 hectares south of an existing coal terminal, with good access to Prince Rupert and Port Edward. The site is held under long term lease by the Prince Rupert Port Corporation. A master plan for the island proposes extensive port development focussing on large scale transfer, storage and processing of primary bulk commodities. Extensive dredging and filling would be required for foreshore development. The site offers deep water access on Chatham Sound and shallow water access within Porpoise Harbour. The major environmental concern is the close proximity of the Skeena River estuarine habitat just south of the island, including important rearing habitat around Flora Bank which could be affected by toxic spills. About 8000 salmon and steelhead spawn in the streams around Prince Rupert Harbour and over 3,000,000 salmon utilize the Skeena estuary.

PORT SITE: RIDLEY ISLAND

PHYSICAL

1.	Developable Area:	375 hectares
2.	Berth Potential:	4
3.	Depth & Dredging Requirements:	2 metres, significant dredging
4.	Terrain:	Organic, bedrock
5.	Watercourses:	None
6.	Natural Hazards:	Low potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	3	31
	Intertidal Mud & Sand:	12	505
	Shallow Water Estuarine:	343	1590
	Other, riparian:	No data	No data
	Total:	**358**	**2126**

8.	Average Salmon Escapement:	0	*3,000,000*
9.	Other Fish & Marine Life:	Crab, clams, herring, groundfish, harbour seal	
10.	Birds:	Low populations - bird count of 600, 35 species	

SOCIAL

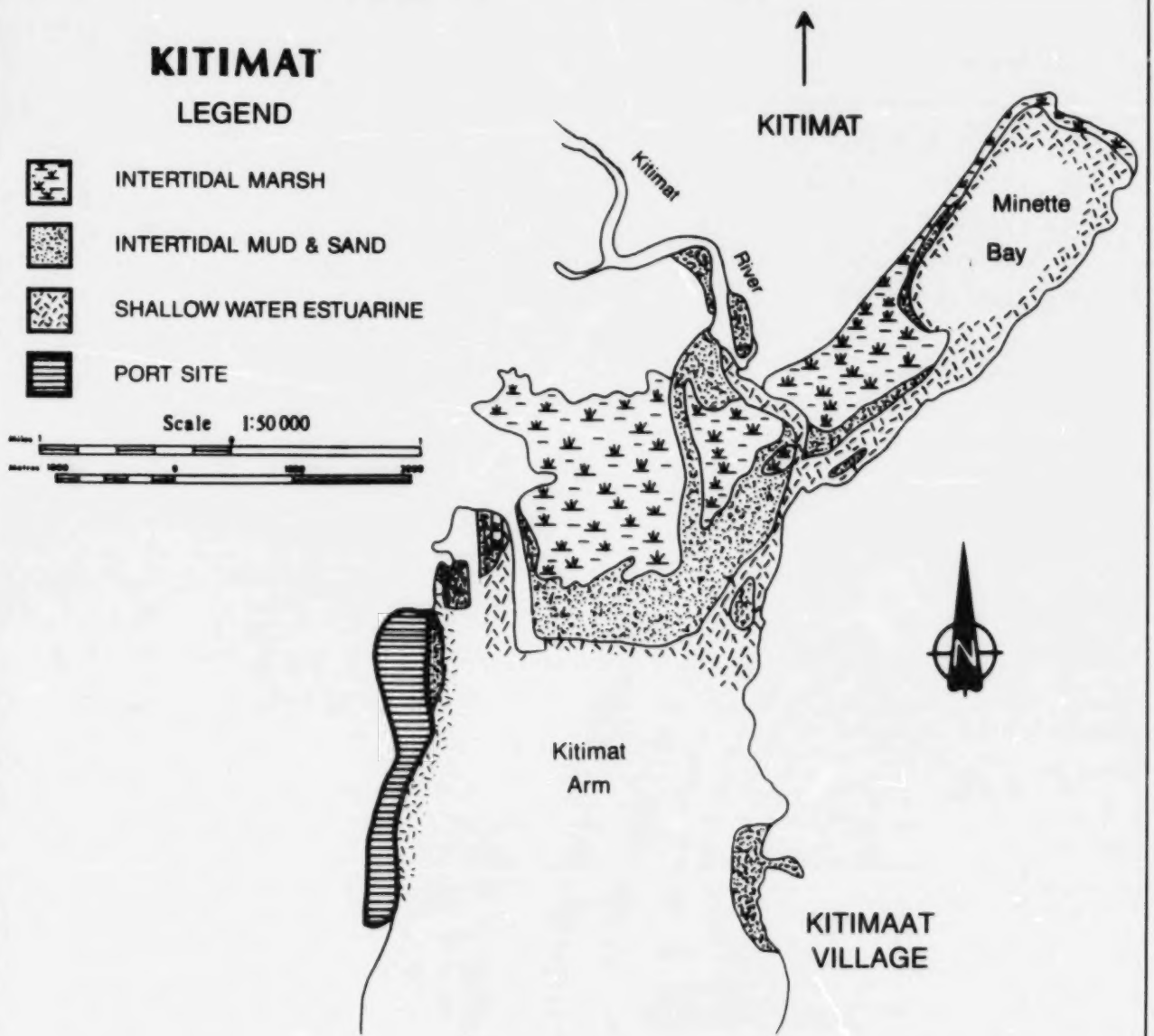
11.	Population (1986):	704 - Port Edward
12.	Land Use:	Coal and grain terminals
13.	Foreshore Use:	Log storage, wharf facilities
14.	Fisheries:	Recreational & commercial salmon, groundfish, herring
15.	Heritage Sites:	1

SERVICES

16.	Road Access:	Industrial road
17.	Rail Access:	CN Rail
18.	Development Services:	Electricity, community water

LAND STATUS:

19.	Ownership:	Crown, Prince Rupert Port Corporation
20.	Crown Status:	Log storage leases
21.	Zoning:	Industrial



This 30 hectare site extends south of the Alcan terminal along a narrow bench on the west shore of Kitimat Arm. It has little developable backshore land because of steep topography and potential geotechnical problems, but there is abundant backup land in the nearby Kitimat Valley. Much of the near foreshore is shallow requiring fill or substantial pier construction for marine access. The site is good for vessels approaching and manoeuvring. Although the Kitimat estuary is a major environmental resource and the fish stocks which it supports are the basis for commercial, recreational and Native food fisheries, the site itself is located away from the primary estuarine area.

PORT SITE: KITIMAT

PHYSICAL

1.	Developable Area:	30 hectares
2.	Berth Potential:	3
3.	Depth & Dredging Requirements:	0 metres, significant dredging or pier construction
4.	Terrain:	Marine
5.	Watercourses:	None
6.	Natural Hazards:	High slope instability potential both land and marine, westerly exposure

BIOLOGICAL

7.	Estuarine Habitat (hectares)		Site	Area (within 5 km)
		Intertidal Marsh:	0	292
		Intertidal Mud & Sand:	14	323
		Shallow Water Estuarine:	14	190
		Other, riparian:	0	1024
		Total:	**28**	**1829**
8.	Average Salmon Escapement:		*78,302*	*78,302*
9.	Other Fish & Marine Life:		Crab	
10.	Birds:		High populations - bird count of 9,300, 117 species	

SOCIAL

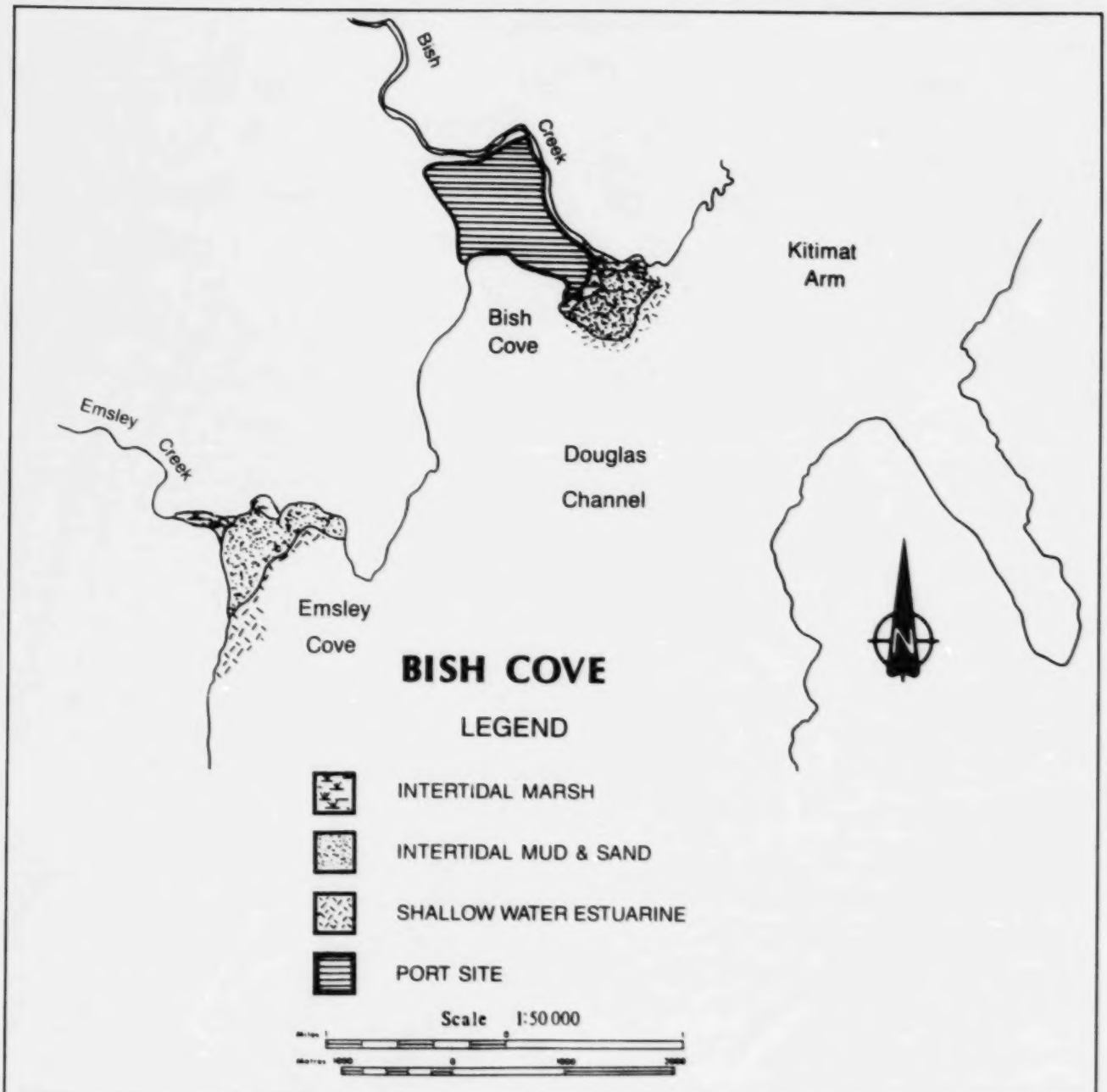
11.	Population (1986):	11,196 - Kitimat
12.	Land Use:	Port facilities, marina
13.	Foreshore Use:	Wharf facilities
14.	Fisheries:	Commercial, recreational & Native salmon
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	Industrial road
17.	Rail Access:	CN Rail - 1km distant
18.	Development Services:	Electricity, community water

LAND STATUS:

19.	Ownership:	Private, Alcan Aluminium, Riv Tow Straits Ltd
20.	Crown Status:	Not applicable
21.	Zoning:	Industrial use proposed



The Bish Cove site incorporates about 80 hectares at the uninhabited Bish Indian Reserve, 8 km south of Kitimat. Marine access is considered good, but the site is somewhat exposed to southerly winds in Douglas Channel. The site has been previously considered for an LNG terminal. Major development costs relate to lack of road access. While Bish Creek has large salmon stocks, the site itself is set back from the creek. A small estuary is located at nearby Emsley Creek. No other significant environmental concerns have been identified. A salmon net fishery occurs in Douglas Channel during summer periods so that careful vessel scheduling would be required. Native interests are an important consideration at this site.

PORT SITE: BISH COVE

PHYSICAL

1.	Developable Area:	80 hectares
2.	Berth Potential:	1
3.	Depth & Dredging Requirements:	10 metres, minor dredging
4.	Terrain:	Bedrock, fluvial
5.	Watercourses:	Bish Creek
6.	Natural Hazards:	Low potential, exposure to southerly winds

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)	
	Intertidal Marsh:	0	10	
	Intertidal Mud & Sand:	0	40	
	Shallow Water Estuarine:	0	15	
	Other, riparian:	0	No data	
	Total:	**0**	**65**	
8.	Average Salmon Escapement:	17,404	18,982	
9.	Other Fish & Marine Life:	Crab, shrimp, prawn		
10.	Birds:	Low populations		

SOCIAL

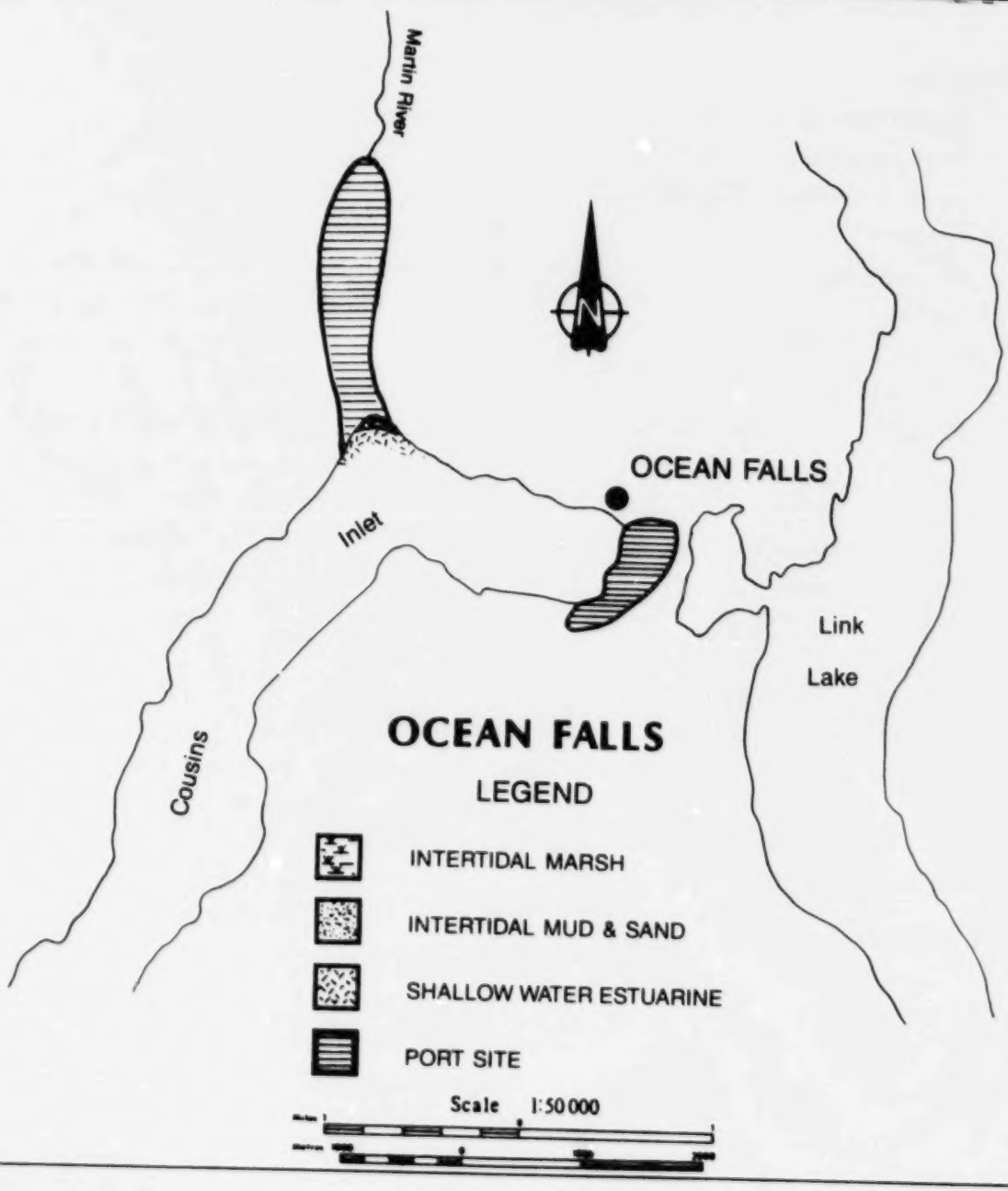
11.	Population (1986):	None
12.	Land Use:	None
13.	Foreshore Use:	None
14.	Fisheries:	Native, commercial & recreational salmon, shrimp, prawn
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	10 km industrial road required
17.	Rail Access:	None
18.	Development Services:	None

LAND STATUS:

19.	Ownership:	Indian Reserve
20.	Crown Status:	Not applicable
21.	Zoning:	Not applicable



The Ocean Falls site includes approximately 100 hectares within two sub areas. Not all of the site is useable because of existing development. The area near the mill site at the head of the inlet is best suited for port development. Other developable land is in the valley of the Martin River, an important fish-bearing stream. Major attributes of the site include excellent deep water, a sheltered harbour and remnant townsite facilities. Exports of freshwater may become an important activity in the area. The site is limited by a lack of road and rail access and its remote location at the head of Cousins Inlet.

PORT SITE: OCEAN FALLS

PHYSICAL

1.	Developable Area:	10 ectares
2.	Berth Potential:	2
3.	Depth & Dredging Requirements:	10 metres, no dredging
4.	Terrain:	Fluvial, marine
5.	Watercourses:	Martin Creek
6.	Natural Hazards:	Moderate flooding potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	1	1
	Intertidal Mud & Sand:	3	3
	Shallow Water Estuarine:	3	3
	Other, riparian:	0	0
	Total:	**7**	**7**

8.	Average Salmon Escapement:	5605	5605
9.	Other Fish & Marine Life:	Shrimp, prawn	
10.	Birds:	Low populations	

SOCIAL

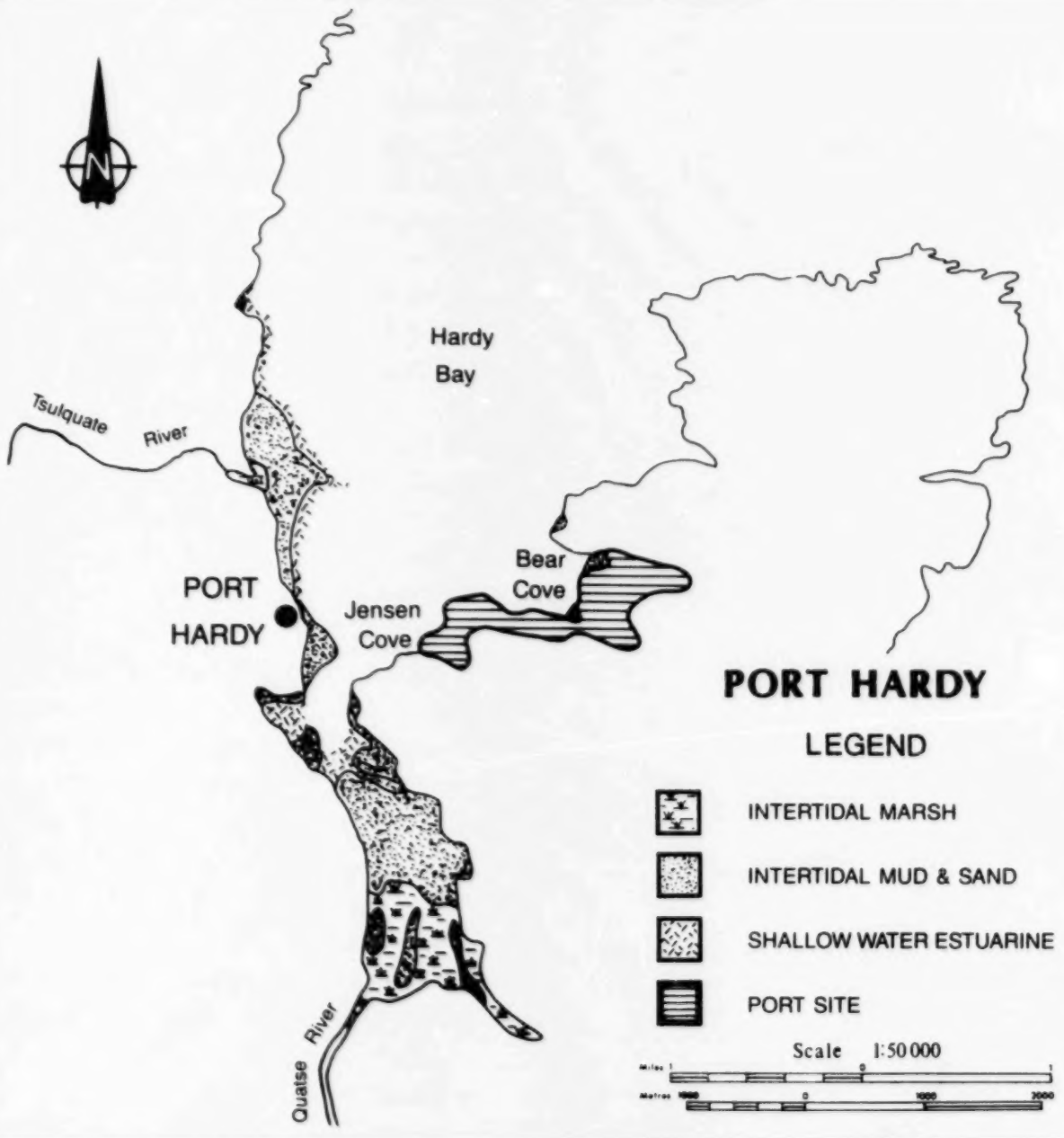
11.	Population (1986):	12
12.	Land Use:	Townsite
13.	Foreshore Use:	Log storage
14.	Fisheries:	Prawn, shrimp
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	None
17.	Rail Access:	None
18.	Development Services:	Electricity, community water, sewer

LAND STATUS:

19.	Ownership:	Crown
20.	Crown Status:	Industrial lease
21.	Zoning:	None



The Port Hardy site is located around Jensen Cove and Bear Cove, the site of the B.C. Ferries terminal. The developable land is approximately 90 hectares, more than half of which is privately owned. There is relatively good deep water access with moderate to steep backshore topography. The site has low environmental values, although the nearby Quatse and Tsulquate Rivers have large estuaries and fish stocks. Much of the site has been designated by the District of Port Hardy for industrial use.

PORT SITE: PORT HARDY

PHYSICAL

1.	Developable Area:	90 hectares
2.	Berth Potential:	2
3.	Depth & Dredging Requirements:	4 metres, minor dredging
4.	Terrain:	Colluvial
5.	Watercourses:	Quatse River nearby
6.	Natural Hazards:	Moderate slope instability potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	0	50
	Intertidal Mud & Sand:	1	130
	Shallow Water Estuarine:	1	68
	Other, riparian:	0	No data
	Total:	**2**	**248**
8.	Average Salmon Escapement:	0	41,619
9.	Other Fish & Marine Life:	Herring spawning, killer whale migration	
10.	Birds:	High populations - waterfowl & seabirds	

SOCIAL

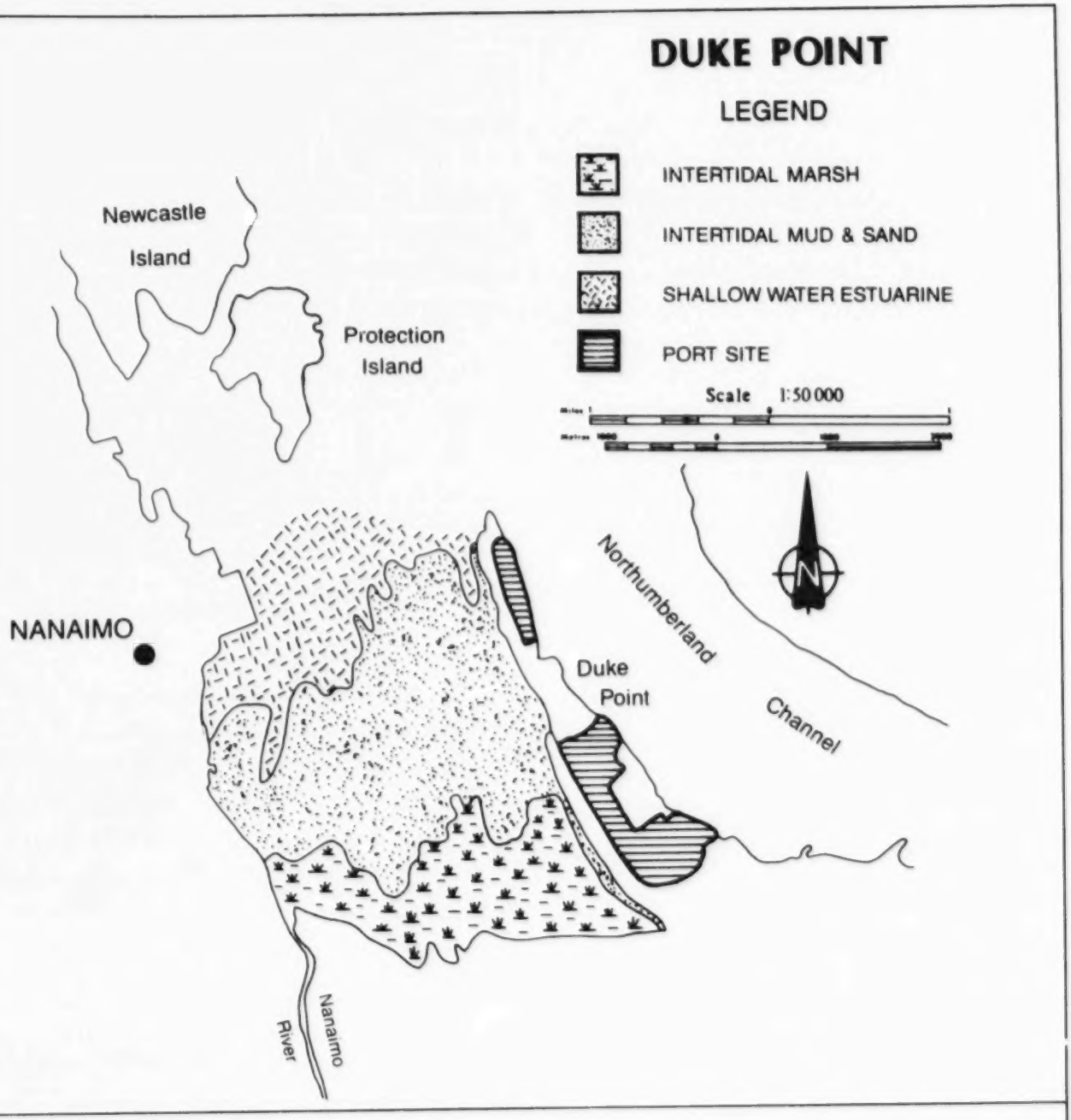
11.	Population (1986):	5389 - Port Hardy
12.	Land Use:	B.C. Ferries terminal
13.	Foreshore Use:	Log storage
14.	Fisheries:	Recreational, commercial & Native salmon
15.	Heritage Sites:	4

SERVICES

16.	Road Access:	Local road
17.	Rail Access:	None
18.	Development Services:	Electricity

LAND STATUS:

19.	Ownership:	Crown, private
20.	Crown Status:	Vacant
21.	Zoning:	Industrial



The Duke Point industrial park near Nanaimo offers 70 hectares of vacant land with deep water shipping access. A sawmill and shipping terminal presently exist at the fully serviced site and a ferro-chromium plant is proposed. No major environmental concerns are found at the site which fronts on Northumberland Channel, although the nearby Nanaimo River estuary is of high importance for aquatic and bird populations.

PORT SITE: DUKE POINT

PHYSICAL

1.	Developable Area:	70 hectares
2.	Berth Potential:	5+
3.	Depth & Dredging Requirements:	7 metres, no dredging
4.	Terrain:	Bedrock
5.	Watercourses:	None
6.	Natural Hazards:	Low potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	0	168
	Intertidal Mud & Sand:	0	544
	Shallow Water Estuarine:	0	80
	Other, riparian:	0	108
	Total:	**0**	**900**
8.	Average Salmon Escapement:	0	32,859
9.	Other Fish & Marine Life:	Occasional marine mammals	
10.	Birds:	Low populations	

SOCIAL

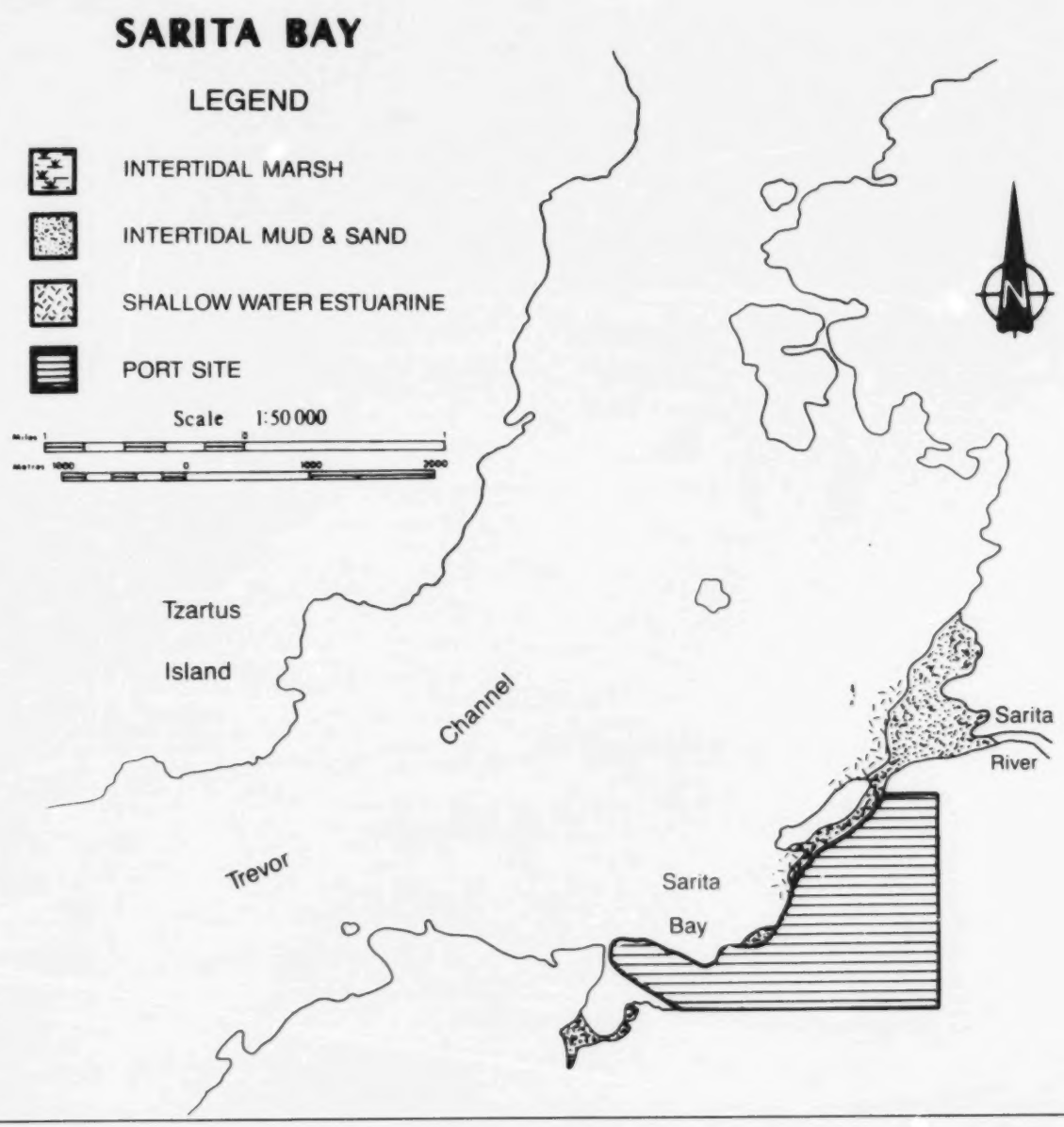
11.	Population (1986):	49,029 - Nanaimo
12.	Land Use:	Sawmill, shipping terminal, proposed ferro-chromium plant
13.	Foreshore Use:	Wharves, log storage
14.	Fisheries:	Recreational salmon
15.	Heritage Sites:	5

SERVICES

16.	Road Access:	Industrial road
17.	Rail Access:	CP Rail - 5 km distant
18.	Development Services:	Electricity, community water

LAND STATUS:

19.	Ownership:	B.C. Enterprise Corporation, Crown
20.	Crown Status:	Industrial lease
21.	Zoning:	Industrial



Sarita Bay is a site of over 200 hectares located on Trevor Channel in Barkley Sound. The site is sheltered by islands and has a northerly aspect, providing protection from southwesterly winds. Portions of the site are presently used as a log handling facility. High wildlife, fish, forest and recreational values exist throughout the general area. There is little estuarine habitat at the site, but the nearby Sarita River estuary is a locally important resource.

PORT SITE: SARITA BAY

PHYSICAL

1.	Developable Area:	215 hectares
2.	Berth Potential:	1
3.	Depth & Dredging Requirements:	10 metres, minor dredging
4.	Terrain:	No data, shoreline partly rock cliff
5.	Watercourses:	Unnamed creek, Sarita River
6.	Natural Hazards:	Low potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	No data	No data
	Intertidal Mud & Sand:	3	61
	Shallow Water Estuarine:	5	27
	Other, riparian:	No data	No data
	Total:	**8**	**88**
8.	Average Salmon Escapement:	0	38,120
9.	Other Fish & Marine Life:	Crab, prawn, herring	
10.	Birds:	Moderate seabird populations	

SOCIAL

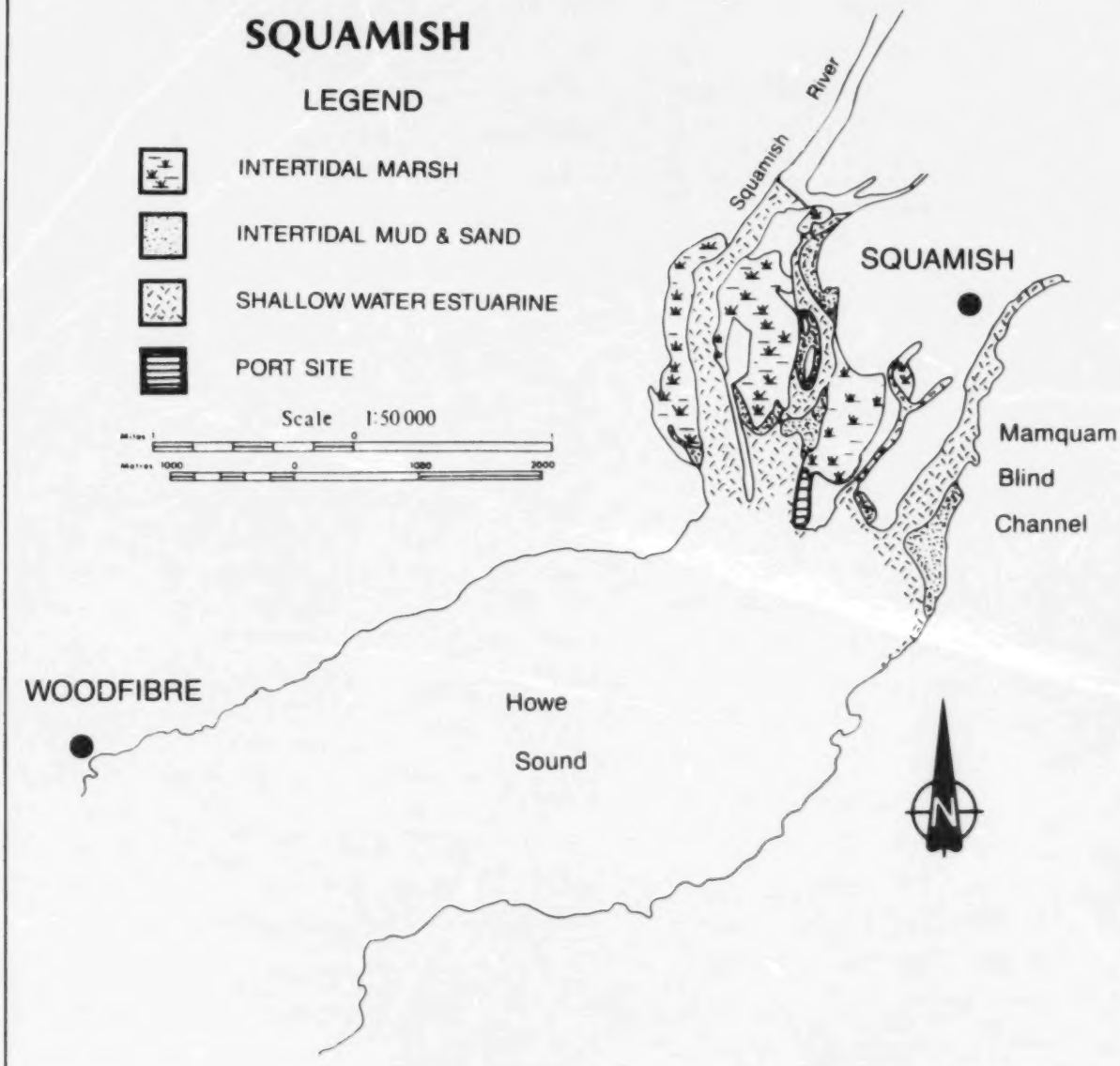
11.	Population (1986):	None
12.	Land Use:	Log dump
13.	Foreshore Use:	Log booming
14.	Fisheries:	Native, commercial & recreational salmon
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	Industrial road
17.	Rail Access:	None
18.	Development Services:	None

LAND STATUS:

19.	Ownership:	Crown
20.	Crown Status:	Tree Farm Licence 44 - MacMillan Bloedel
21.	Zoning:	Forest reserve



The Squamish site is located on designated industrial land adjacent to existing port facilities. About 4 hectares of industrial land remains undeveloped. The site is well serviced with good access to the town of Squamish. The Squamish Estuary Management Plan describes the surrounding habitat as critical, thus restricting the potential for site expansion. The Squamish estuary encompasses about 475 hectares of important habitat. New proposals for industrial land reclamation would pose major environmental concerns.

PORT SITE: SQUAMISH

PHYSICAL

1.	Developable Area:	4 hectares
2.	Berth Potential:	1
3.	Depth & Dredging Requirements:	0 metres, significant dredging
4.	Terrain:	Anthropogenic
5.	Watercourses:	Squamish River
6.	Natural Hazards:	Moderate flooding potential

BIOLOGICAL

7. Estuarine Habitat (hectares)	Site	Area (within 5 km)
Intertidal Marsh	1	125
Intertidal Mud & Sand	1	100
Shallow Water Estuarine	0	250
Other, riparian	0	No data
Total:	**2**	**475**

8.	Average Salmon Escapement:	*93,881*	*93,881*
9.	Other Fish & Marine Life:	Harbour seal, herring, crab	
10.	Birds:	High populations - 42,000 bird count, 67 species	

SOCIAL

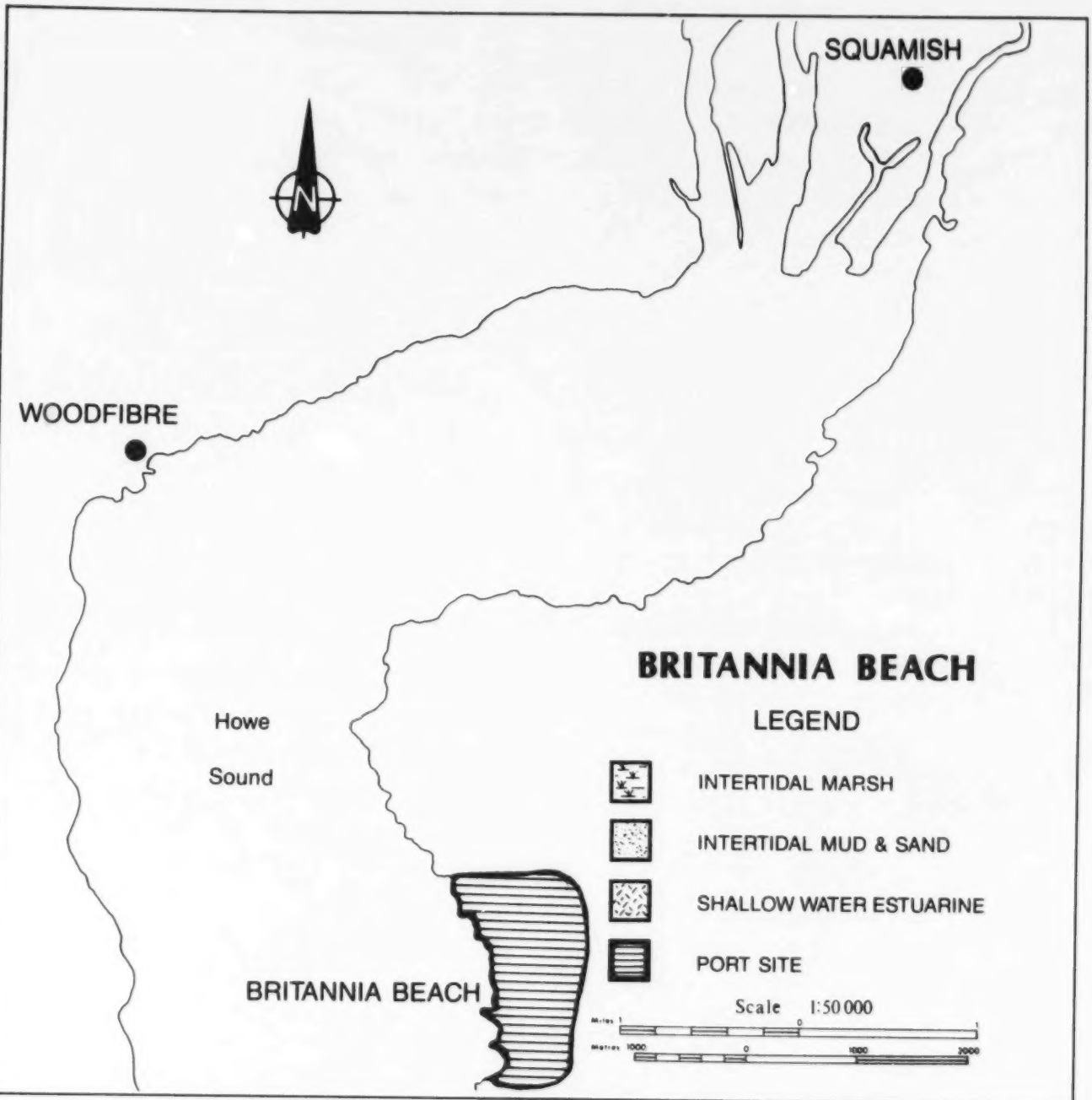
11.	Population (1986):	10,517 - Squamish
12.	Land Use:	Port facilities
13.	Foreshore Use:	Wharves
14.	Fisheries:	Recreational & Native salmon
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	Local road
17.	Rail Access:	B.C. Rail
18.	Development Services:	Electricity, community water

LAND STATUS:

19.	Ownership:	B.C. Rail
20.	Crown Status:	Not applicable
21.	Zoning:	Industrial



The site at Britannia Beach incorporates 80 hectares of mainly private land suitable for industrial use. A mining museum and a small residential community are adjacent . There is little estuarine habitat at the site, limiting the environmental concerns, although Howe Sound is an important recreational fishing, boating and diving area. Most of the development concerns relate to potential social and recreational impacts and effects on the B.C. Railway and Highway 99 right-of-ways through the site.

PORT SITE: BRITANNIA BEACH

PHYSICAL

1.	Developable Area:	80 hectares
2.	Berth Potential:	1
3.	Depth & Dredging Requirements:	8 metres, minor dredging
4.	Terrain:	Fluvial
5.	Watercourses:	Britannia Creek
6.	Natural Hazards:	High flooding/debris hazard potential, high earthquake slumping potential

BIOLOGICAL

7. Estuarine Habitat (hectares)	Site	Area (within 5 km)
Intertidal Marsh:	0	8
Intertidal Mud & Sand:	1	2
Shallow Water Estuarine:	0	1
Other, riparian:	0	No data
Total:	**1**	**11**

8.	Average Salmon Escapement:	0	0
9.	Other Fish & Marine Life:	Occasional marine mammals	
10.	Birds:	Low populations	

SOCIAL

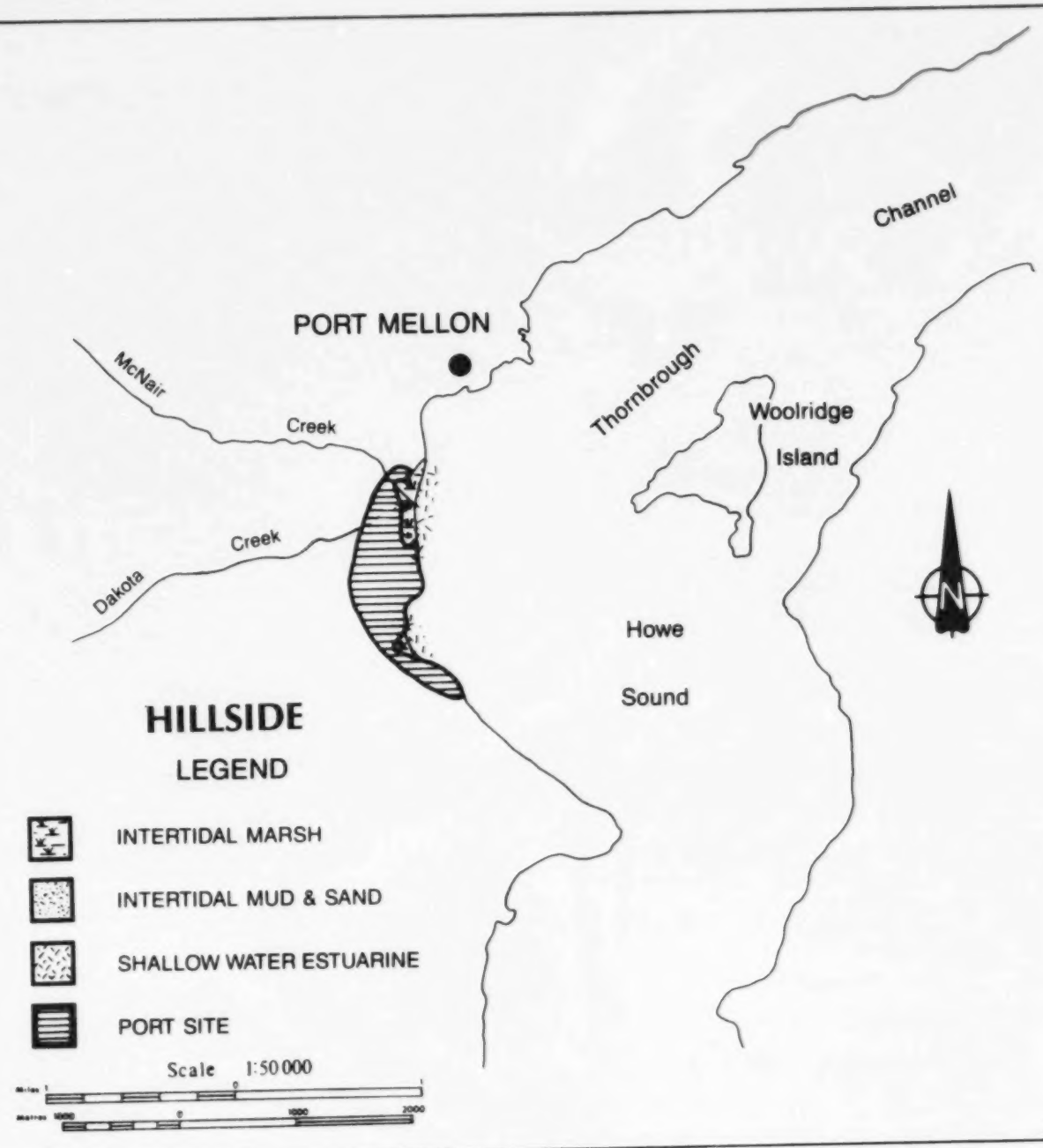
11.	Population (1986):	10,517 - Squamish, 210 - Britannia Beach
12.	Land Use:	Residential, recreational
13.	Foreshore Use:	Public wharf
14.	Fisheries:	Recreational salmon
15.	Heritage Sites:	Mining museum

SERVICES

16.	Road Access:	Highway 99
17.	Rail Access:	B.C. Rail
18.	Development Services:	Electricity, community water

LAND STATUS:

19.	Ownership:	Private
20.	Crown Status:	Not applicable
21.	Zoning:	None



The Hillside site, south of Port Mellon, comprises 53 hectares of developable land highly suited for industrial use. Any development constraints relate primarily to Dakota and McNair Creeks where relatively minor fisheries and flooding hazards exist. The site has excellent deep water and road access. Existing uses include a small sawmill and log sorting operation with a small residential area nearby. The site is presently proposed as a forest products industrial park.

PORT SITE: HILLSIDE

PHYSICAL

1.	Developable Area:	53 hectares
2.	Berth Potential:	4
3.	Depth & Dredging Requirements:	20 metres, minor dredging
4.	Terrain:	Fluvial, marine
5.	Watercourses:	Dakota and McNair Creeks
6.	Natural Hazards:	Moderate flooding potential

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	8	10
	Intertidal Mud & Sand:	2	5
	Shallow Water Estuarine:	1	2
	Other, riparian:	No data	No data
	Total:	**11**	**17**
8.	Average Salmon Escapement:	100	200
9.	Other Fish & Marine Life:	Occasional marine mammals	
10.	Birds:	Low populations	

SOCIAL

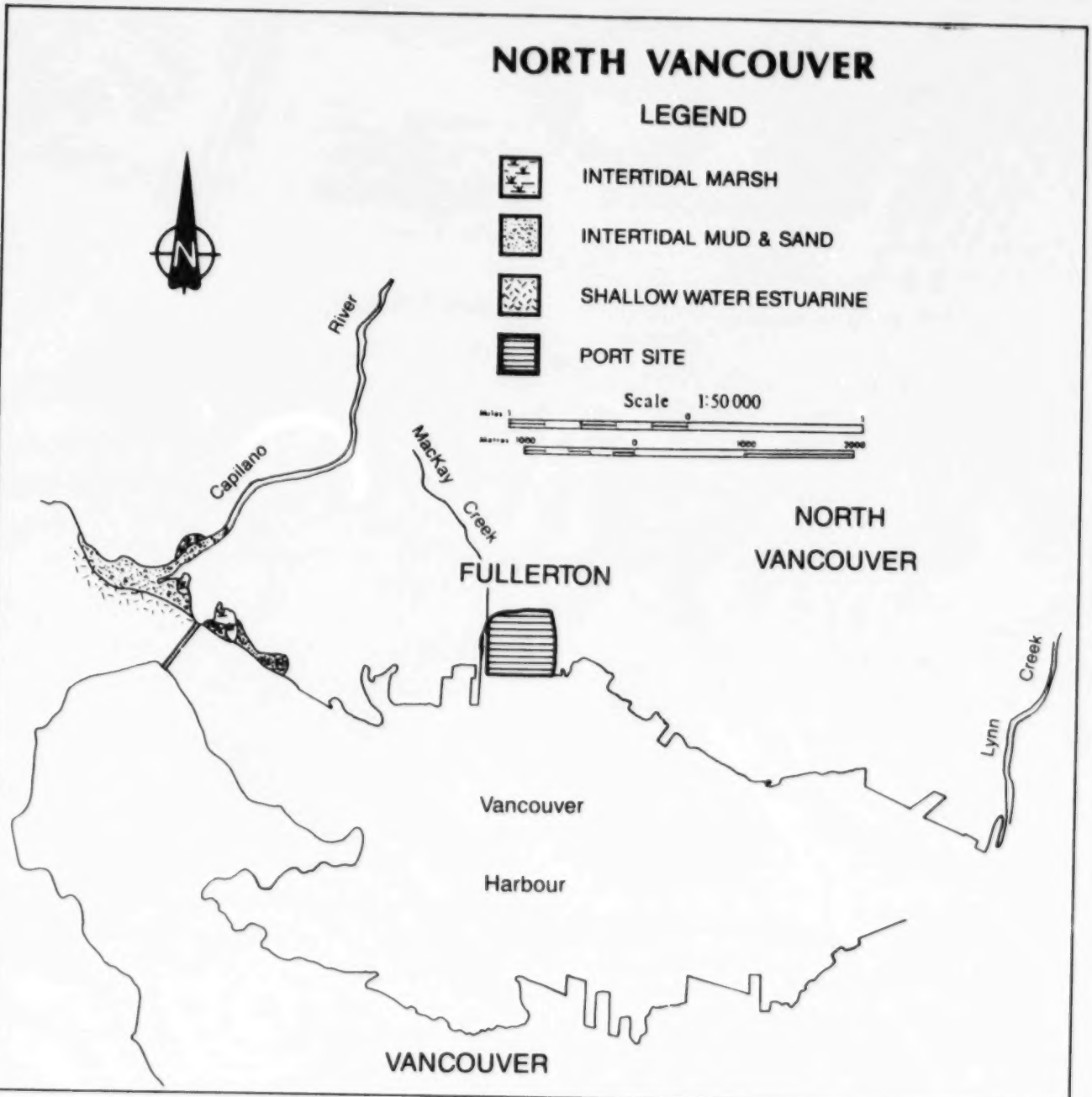
11.	Population (1986):	Approximately 20
12.	Land Use:	Sawmill, log debris burning, gravel pits
13.	Foreshore Use:	Log storage & sorting
14.	Fisheries:	Recreational & Native salmon
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	Port Mellon Highway
17.	Rail Access:	None
18.	Development Services:	Electricity

LAND STATUS:

19.	Ownership:	Genstar, Fleetwood Industries, Riv Tow
20.	Crown Status:	Log storage leases
21.	Zoning:	Industrial



Expansion of port facilities in North Vancouver is possible at the Fullerton site which incorporates about 25 hectares of reclaimed industrial land. Although marine access is somewhat congested, the site is suitable for vessels up to 100,000 dwt. Within Vancouver Harbour, the major environmental concerns relate to risks to the Capilano River and Lynn Creek fisheries. Social concerns are primarily safety-related.

PORT SITE: NORTH VANCOUVER

PHYSICAL

1.	Developable Area:	25 hectares
2.	Berth Potential:	2
3.	Depth & Dredging Requirements:	20 metres, minor dredging
4.	Terrain:	Anthropogenic
5.	Watercourses:	MacKay Creek
6.	Natural Hazards:	Low potential

BIOLOGICAL

7. Estuarine Habitat (hectares)

	Site	Area (within 5 km)
Intertidal Marsh:	0	3
Intertidal Mud & Sand:	1	16
Shallow Water Estuarine:	0	2
Other, riparian:	0	No data
Total:	**1**	**21**

8.	Average Salmon Escapement:	150	5492
9.	Other Fish & Marine Life:	Low	
10.	Birds:	Low populations	

SOCIAL

11.	Population (1986):	68,241 - North Vancouver
12.	Land Use:	Port facilities
13.	Foreshore Use:	Industrial
14.	Fisheries:	Recreational salmon
15.	Heritage Sites:	None recorded

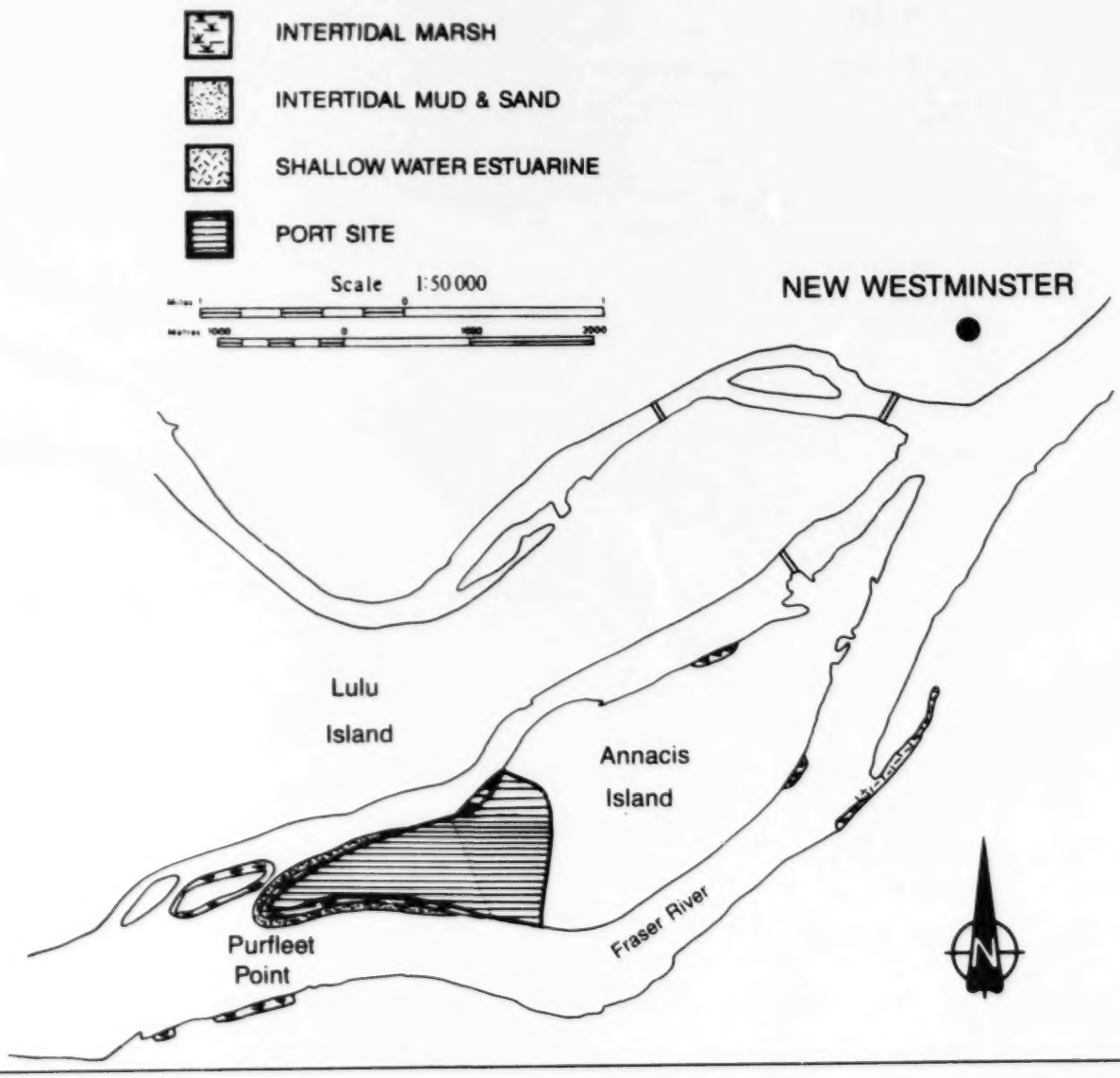
SERVICES

16.	Road Access:	Local road
17.	Rail Access:	B.C. Rail
18.	Development Services:	Electricity, community water, sewer

LAND STATUS:

19.	Ownership:	Private
20.	Crown Status:	Not applicable
21.	Zoning:	Industrial, waterfront permitted use to be determined by site study

ANNACIS ISLAND



The Annacis Island site is located southwest of New Westminster and incorporates about 110 hectares of serviced land within Annacis Business Park. A detailed development site plan has been prepared which provides for intensive light industrial use. Lands at Purfleet Point and other sensitive shoreline areas have been designated for park use. The intertidal foreshore is important rearing and resting habitat for migrating Fraser River fish stocks.

PORT SITE: ANNACIS ISLAND

PHYSICAL

1.	Developable Area:	110 hectares
2.	Berth Potential:	2
3.	Depth & Dredging Requirements:	0 metres, moderate dredging
4.	Terrain:	Fluvial
5.	Watercourses:	Fraser River
6.	Natural Hazards:	Moderate flooding potential, possibility of earthquake slumping

BIOLOGICAL

7.	Estuarine Habitat (hectares)	Site	Area (within 5 km)
	Intertidal Marsh:	11	69
	Intertidal Mud & Sand:	10	0
	Shallow Water Estuarine:	3	16
	Other, riparian:	No data	No data
	Total:	**14**	**85**
8.	Average Salmon Escapement:	*5,000,000*	*5,000,000*
9.	Other Fish & Marine Life:	Riverine species	
10.	Birds:	Moderate populations	

SOCIAL

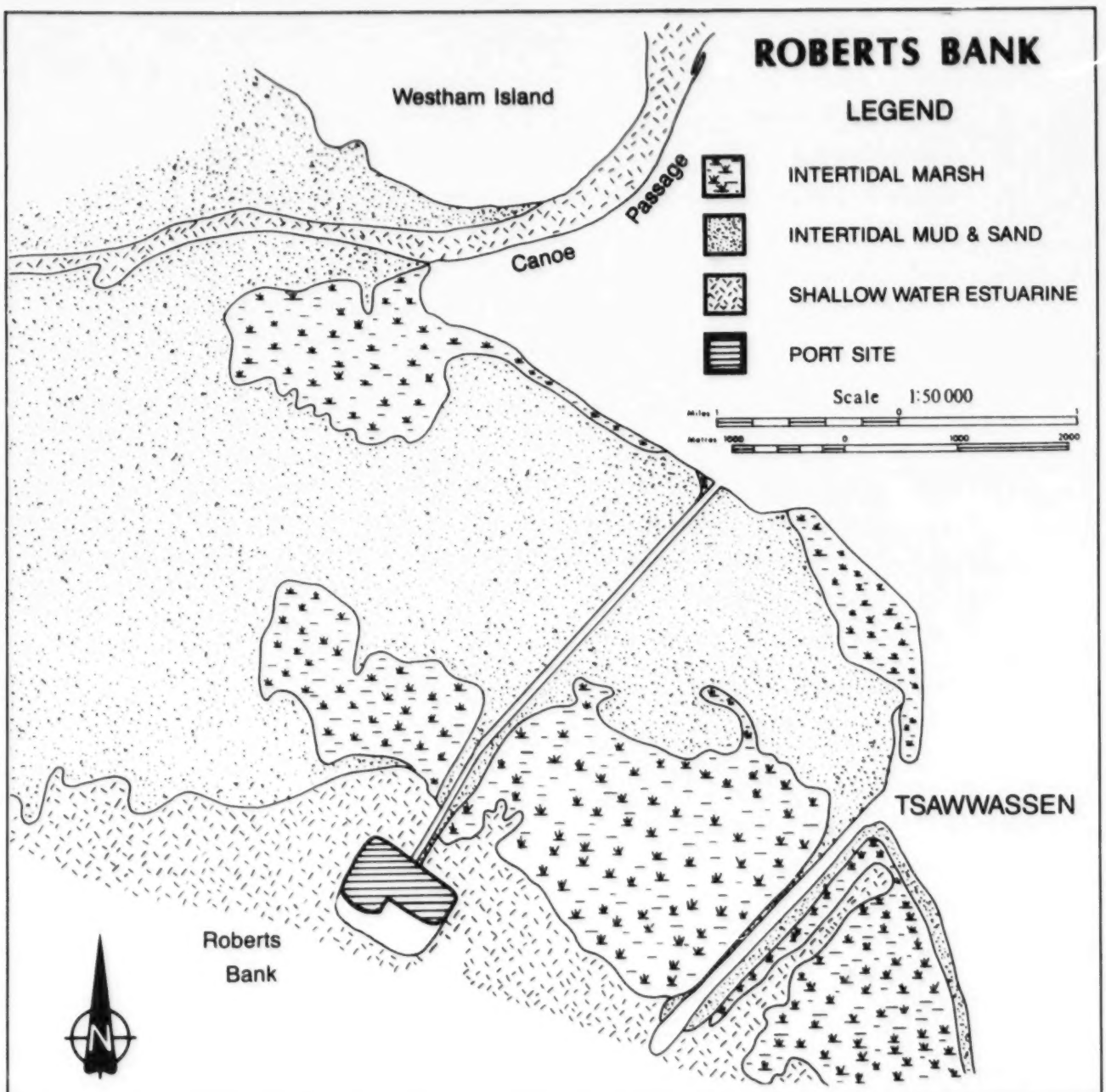
11.	Population (1986):	79,610 - Delta, 39,972 - New Westminster
12.	Land Use:	Industrial Park
13.	Foreshore Use:	Log storage
14.	Fisheries:	Recreational
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	Local road
17.	Rail Access:	1 km distant
18.	Development Services:	Electricity, community water

LAND STATUS:

19.	Ownership:	Grosvenor International Ltd.
20.	Crown Status:	Not applicable
21.	Zoning:	Industrial



This 47 hectare site of developed industrial land is located adjacent to an existing coal terminal on pods created for terminal expansion. Some additional dredging would probably be required for berth development. The Fraser River estuary is a major resource supporting part of the largest fisheries system in the province. Considerable habitat enhancement has been undertaken to offset the impact of industrial development at Roberts Bank.

PORT SITE: ROBERTS BANK

PHYSICAL

1.	Developable Area:	47 hectares
2.	Berth Potential:	2
3.	Depth & Dredging Requirements:	10 metres, moderate dredging
4.	Terrain:	Anthropogenic
5.	Watercourses:	Fraser River
6.	Natural Hazards:	Moderate flooding potential

BIOLOGICAL

7. Estuarine Habitat (hectares)

	Site	Area (within 5 km)
Intertidal Marsh:	0	834
Intertidal Mud & Sand:	2	2962
Shallow Water Estuarine:	18	681
Other, riparian:	0	20
Total:	**20**	**4497**

8.	Average Salmon Escapement:	*5,000,000*	*5,000,000*
9.	Other Fish & Marine Life:	Crab, herring spawning	
10.	Birds:	High populations - daily bird counts of up to 35,000 for Roberts Bank area	

SOCIAL

11.	Population (1986):	None
12.	Land Use:	Coal port facilities
13.	Foreshore Use:	Wharves
14.	Fisheries:	Recreational & commercial salmon, crab
15.	Heritage Sites:	None recorded

SERVICES

16.	Road Access:	Industrial road
17.	Rail Access:	CP Rail
18.	Development Services:	Electricity, community water

LAND STATUS:

19.	Ownership:	Vancouver Port Corporation
20.	Crown Status:	Order-in-Council 908
21.	Zoning:	Industrial

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